

## 4.0 Highways

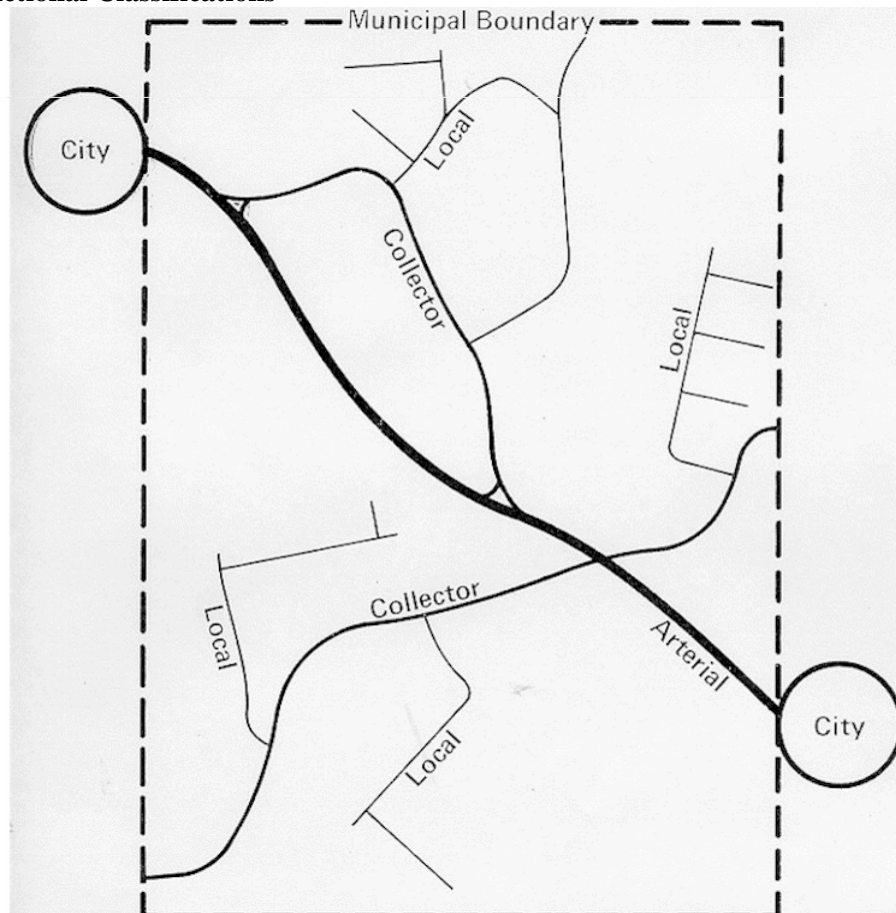
### 4.0 Highways

A backbone of Maine's transportation system is its highway network. The overwhelming majority of people and commodities are moved over the State's public roads and highways. MaineDOT is responsible for 37% of the public road network and 78% of all highway travel in Maine occurs on these roads. Maine's investment in maintaining, developing and upgrading this highway infrastructure is significant. MaineDOT's goal is to cost effectively maintain and protect this investment and upgrade substandard components of the highway system to modern standards. The following details the condition, performance and needs of Maine's highway network.

### 4.1 The State of Maine's Highway Network

- 22,750 miles of public roads
  - 8,368 miles state owned
  - 13,930 miles town ways
  - 452 miles other (Maine Turnpike, reservation, parks, etc)
  - 1,955 miles of unbuilt roadway
  - 1,854 miles of seasonally posted roads
- 27,459 cross culverts
- 28,400 entrance culverts
- 1,590 struts (culverts > 5' & < 10')
- 4.32 million feet of guardrail

#### Highway Functional Classifications



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**Arterial Highways** provide for substantial Statewide or interstate through travel for large traffic volumes at generally high speeds with minimum interference. Depending on their location and function, arterials are categorized as Rural or Urban and as Principal or Minor.

**Major Collector Highways** are outside federal urban areas and serve important intracounty travel corridors that connect consolidated schools, shipping points, important agricultural areas, etc. with local roads.

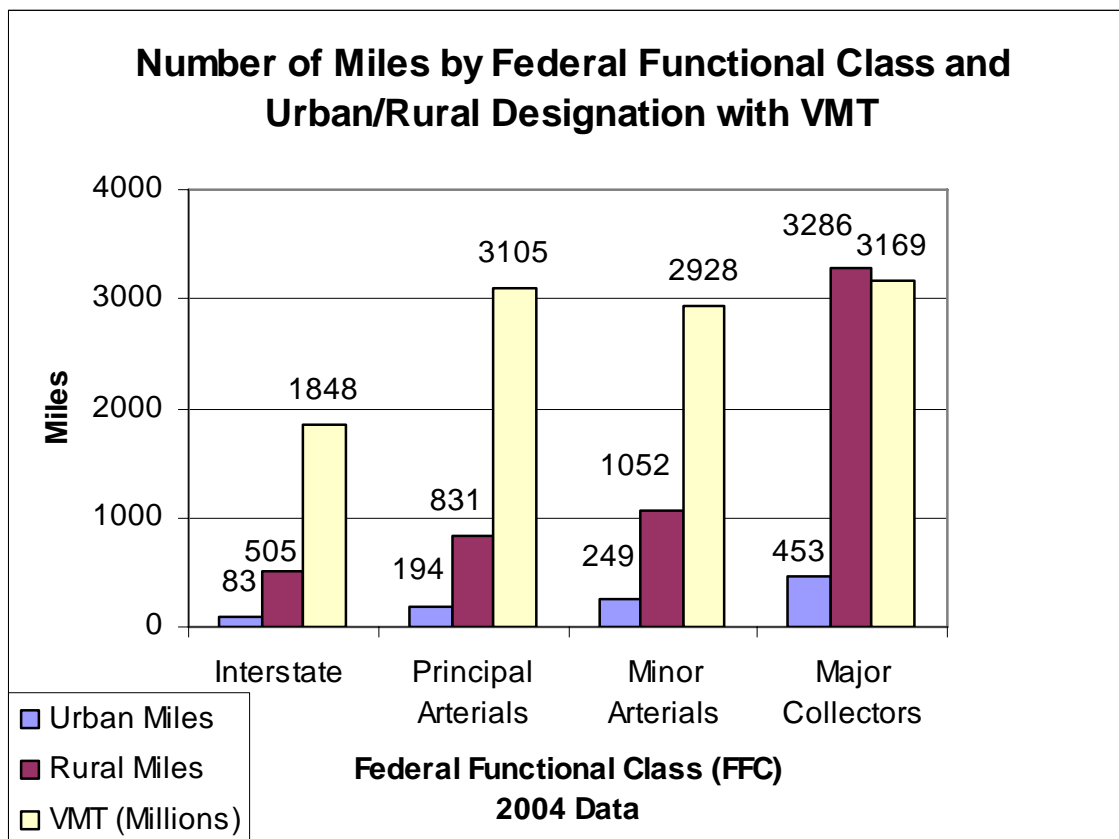
**Urban Collectors** are collector highways inside federal urban areas.

**Minor Collectors** provide service to smaller communities and link locally important traffic generators with arterial and major collector highways.

**Local Roads** provide access to adjacent land and provide service to travel over relatively short distances.

MaineDOT collects pavement data on nearly 9,000 miles of this network, as detailed in the chart below. This data is used primarily to support the Department's Pavement Preservation Program. It focuses on major collectors and higher classifications of roadways, which also carry the majority of all traffic. As an example, arterial highways make up 12% of the network, yet they carry more than 60% of the traffic.

### 4.1 FFC and Urban/Rural Designation with VMT



Note: Interstate mileage includes northbound and southbound lanes of all interstates in Maine (I-95, I-295, I-395), but does not include Maine Turnpike Authority mileage or VMT.

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### 4.2 Highway Adequacy

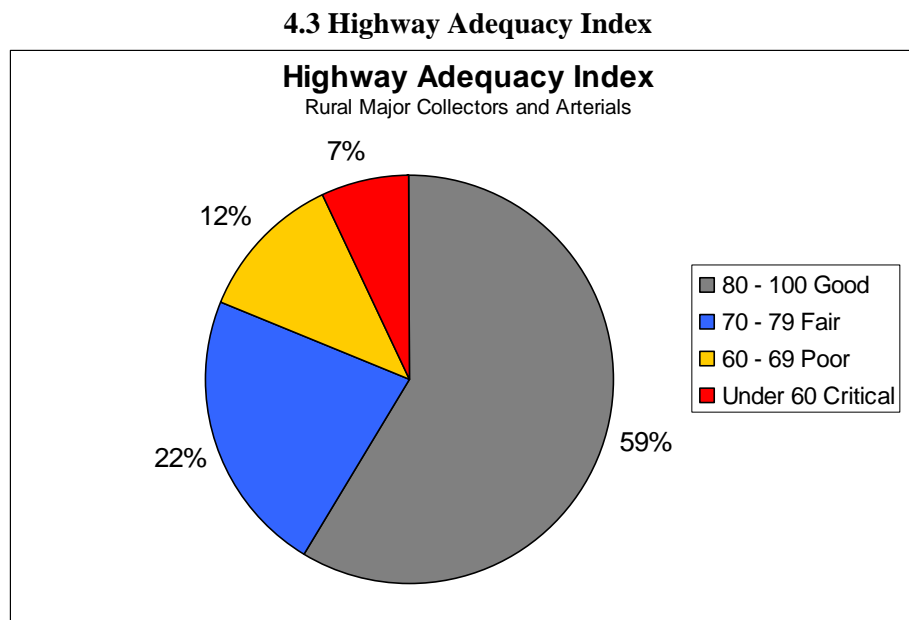
The HAI is an empirical evaluation of the health of a particular highway segment. The HAI is based on 3 basic elements of the roadway: condition, safety, and service. The HAI is a cumulative score on a scale from 0 to 100. The basic elements are listed in the following figure, with their respective point weighting.

4.2 Highway Adequacy Index	
Sub Index	Arterials & Major Collectors Point weighting:
Condition Index	50
Safety Index	25
Service Index	25
<b>Total</b>	<b>100</b>

The resulting index evaluates the condition, safety, and the service provided to the users of a roadway segment. MaineDOT's intent is to utilize this index as a measure of the value of the highway system over time. A complete discussion of the individual factors, their origins, and the methodology for calculation can be found in the Highway Adequacy Report.

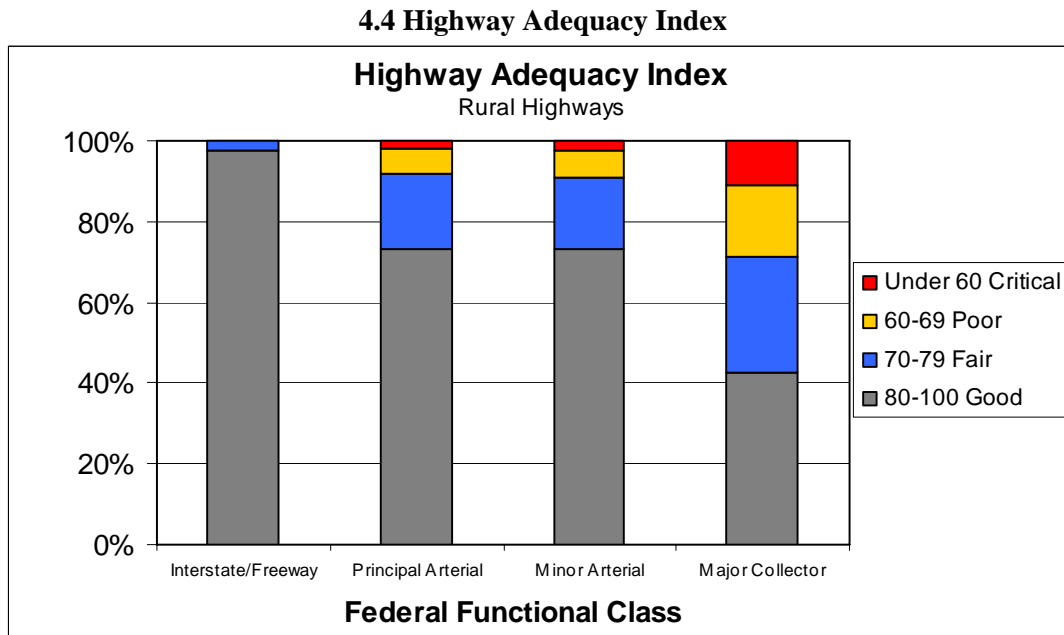
The Adequacy Index in its current form is relatively new with the initial calculations being completed in June 2005. The HAI is scheduled to include new data to better measure the sub-indices for the fall 2006 calculations. These include deficient horizontal curves, deficient vertical curves, stopping sight distance and passing sight distance. The improvements should greatly enhance both the Condition and Safety Indices.

The Adequacy Index on rural roadways depicted below indicates that 59% of the roadway mileage is considered "good" with an index of at least 80, while 7% of the highway mileage is considered to be "critical".



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Within each functional class there are significant differences in the distribution of highway adequacy ratings. The chart below illustrates these variations.



The Interstate System has over 97% of its rural mileage rated “good”. However, this system only comprises slightly over 9% of all rural highway mileage. Conversely, the Major Collector System has only 71% of its rural mileage rated “fair” or “good”, while this system accounts for nearly 58% of the rural mileage. Nearly 90% of all critical mileage is on the Major Collector System.

It is evident that the scoring is currently weighted quite heavily towards the Condition Index which comprises 50% of the Adequacy Index. Thus it is likely not a coincidence that the percentages of highways rated “good” on the major collector system is very similar to the percentage of mileage that has been built. This apparent correlation leads to the conclusion that the best way to improve the overall highway adequacy of a section of highway is to build it to modern highway standards. This conclusion also leads to a very large need to build/rebuild a high percentage of that system. The Highway Adequacy Index will help the Department prioritize the sections which require a treatment.

### 4.3 Highway Conditions

The MaineDOT monitors the condition of approximately 9,000 miles of the State’s public highway network. The monitoring program is performed on a two-year cycle using the Automatic Road Analyzer (ARAN) vehicle. The condition of highways in the Southern half of the state are collected on even numbered years, and the Northern half of the state is collected on odd numbered years. The Interstate System is collected annually.

#### 4.3.1 Built vs. Unbuilt Roads

Maine’s roadway system is split into two distinct categories: built and unbuilt roads. A built road is defined as one that has been constructed to a modern standard, usually post-1950. Modern standards include adequate drainage, base, and pavement to carry the traffic load, and adequate sight distance and width to meet current safety standards. An unbuilt road is defined as a roadway section that has not been

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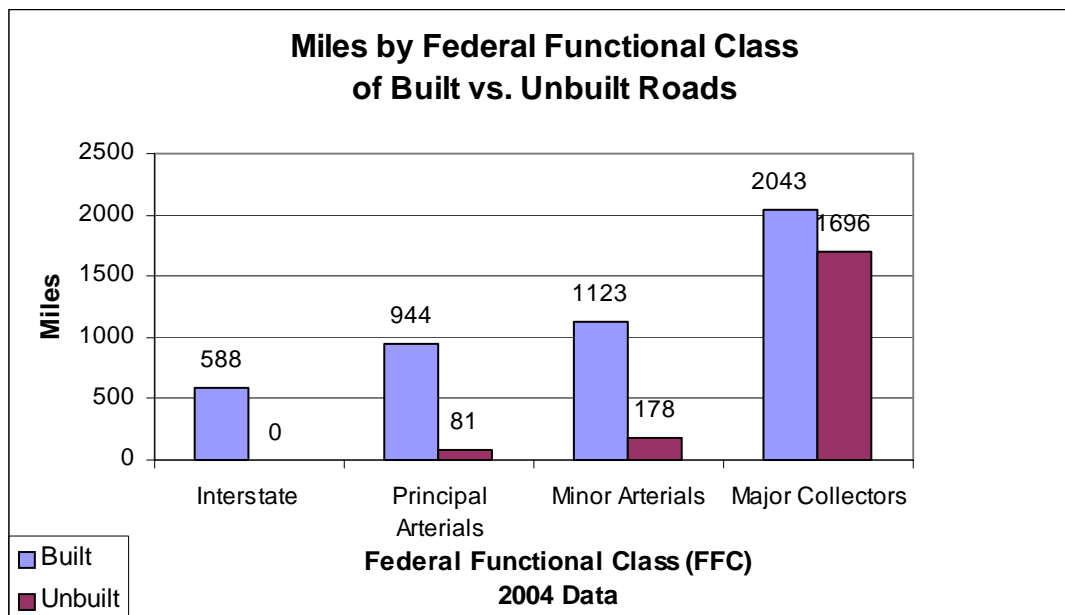
built to modern standards; it may have inadequate drainage, base, and pavement, sight distance and/or width.

### A Built Road



This road has adequate lane width for the given traffic volume, paved shoulders, good sight distance, modern guardrail and curb to protect steep slopes, and good drainage features.

### 4.5 Miles by FFC of Built vs. Unbuilt Roads



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### An Unbuilt Road



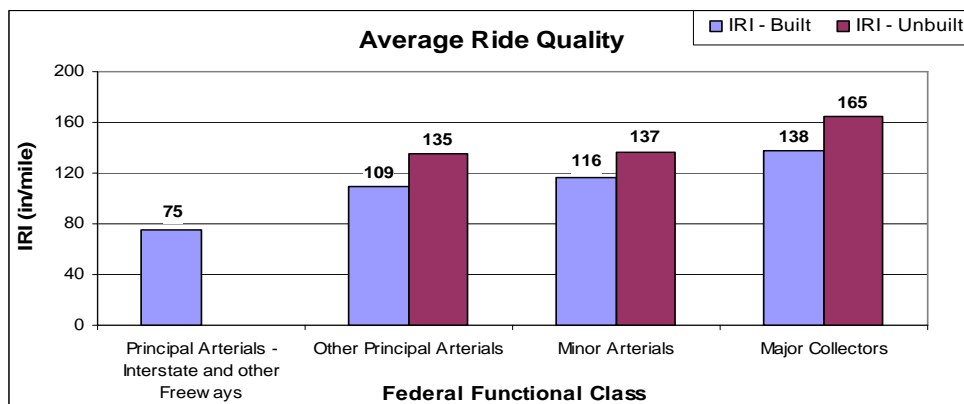
This road has narrow travel lanes, gravel shoulders, poor sight distance (as evidenced by the curve sign in the upper right hand corner), no guardrail protecting the slope to the lake on the left, and no ditches for drainage.

As more miles are improved to meet modern standards, these roads become part of the pavement preservation program that strives to cost effectively keep these roads in good condition.

### 4.3.2 Ride Quality (IRI)

Ride quality has been found to be a key indicator of customer satisfaction. Ride quality is expressed in terms of International Roughness Index (IRI) and is measured in inches of vertical displacement per mile. This is a measurement of the inches of vertical displacement experienced by a vehicle in a mile of roadway. The lower the IRI, the smoother the ride will be. According to the Federal Highway Administration (FHWA), an IRI of less than 170 in/mile is an acceptable ride.

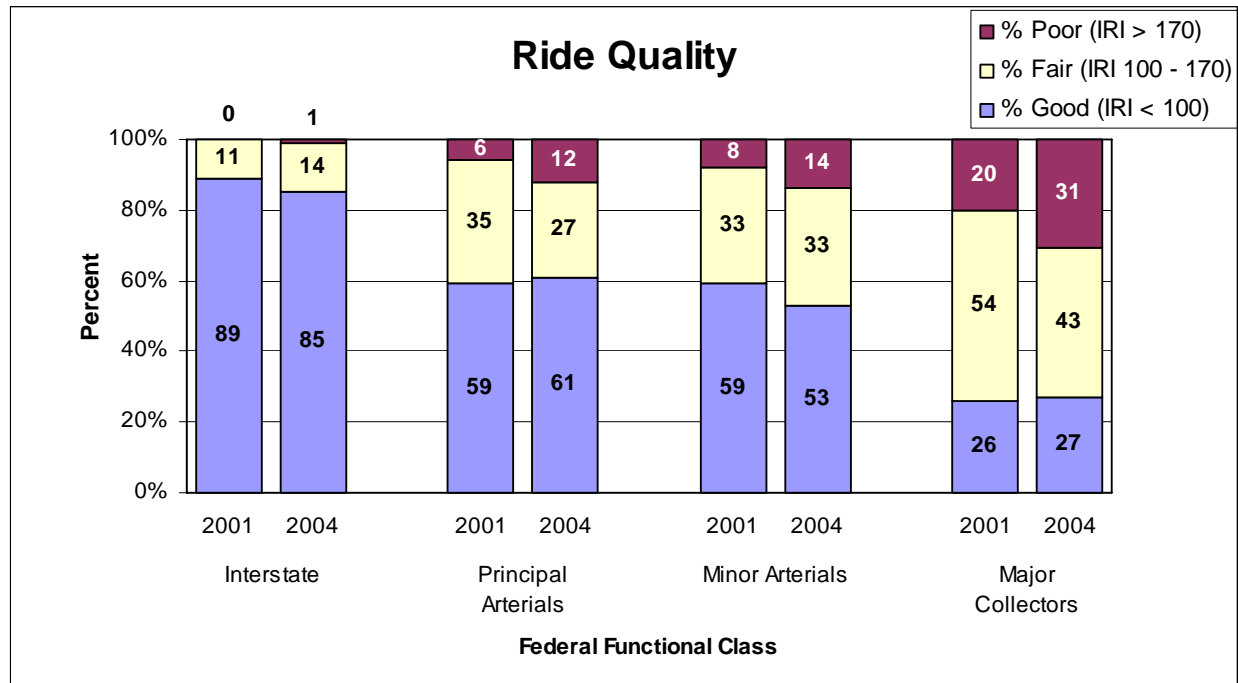
### 4.6 Average Ride Quality



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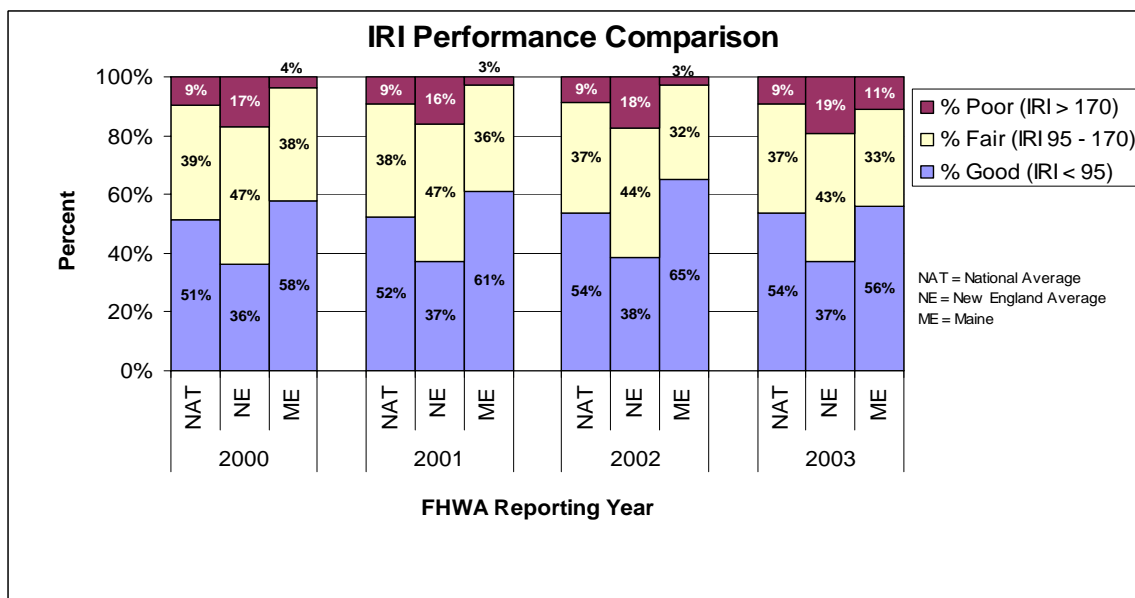
The majority of Maine's Roads measure an IRI value ranging from 50 in/mile to 400 in/mile. The following chart shows the percent of the roads by federal functional class that have a good, fair, and poor ride. For the purposes of this document, a good ride is defined as an IRI of less than 100 in/mile. A fair ride is defined as an IRI of 100-170 in/mile. A poor ride is defined as IRI greater than 170 in/mile.

### 4.7 Ride Quality



2004 Data based on 2003-2004 data of roads collected for pavement management purposes. 2001 Data as reported in the State of the System Report, November 2002.

### 4.8 IRI Performance Comparison



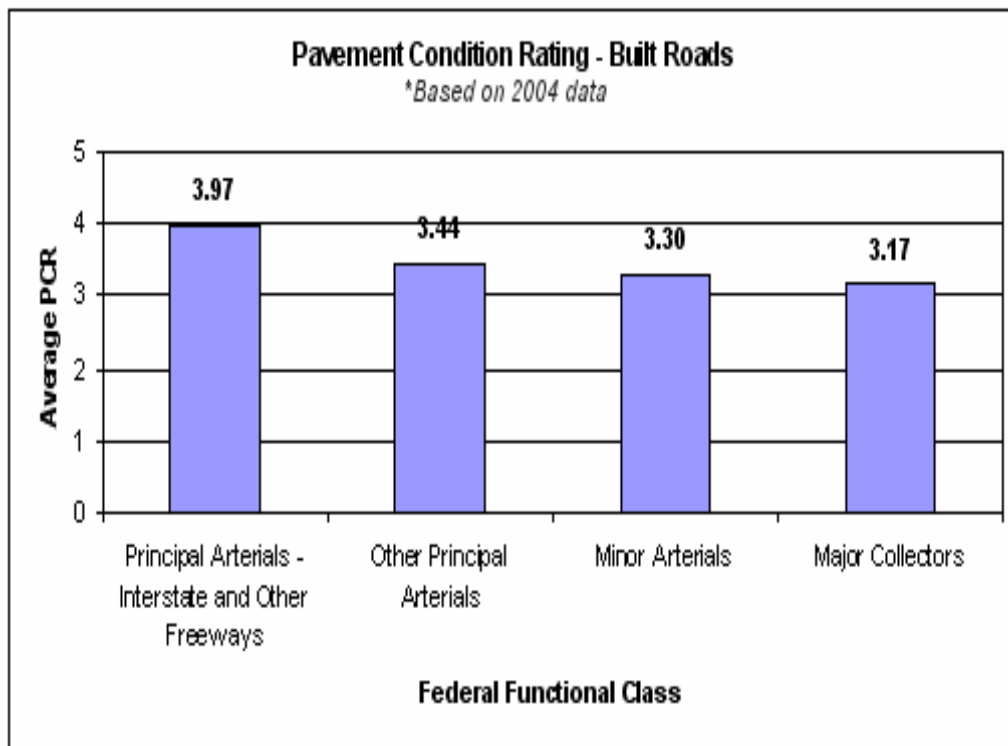
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### 4.3.3 Pavement Condition Ratings (PCR) and Road Conditions

Pavement Condition Rating (PCR) is defined as the composite condition of the pavement on a roadway. The PCR is compiled from the severity and extent of pavement distresses such as cracking, rutting, and patching. The rating system uses a scale of 5.00 (perfect) to 0.00 (fully deteriorated). The PCR is the condition of the pavement only. It is not necessarily a reflection of the condition of the roadway base structure.

<u>PCR</u>	<u>DESCRIPTION</u>
5	<b>EXCELLENT</b> - New or nearly new pavements. Free of cracks, patches or rutting.
4	<b>GOOD</b> - Pavements exhibit little to no visible signs of surface deterioration. Evidence of initial cracking or rutting.
3	<b>FAIR</b> - Visible defects including moderate cracking, distortion and rutting. Some patching may now be present. <i>It is generally most cost effective to treat a road before the PCR drops below this level.</i>
2	<b>POOR</b> - Pavement deterioration consisting of advanced cracking and severe distortion. Extensive patching and rutting also present.
1	<b>VERY POOR</b> - Extremely deteriorated pavements. Defects include severe cracking, distortion, rutting and typically very extensive patching.

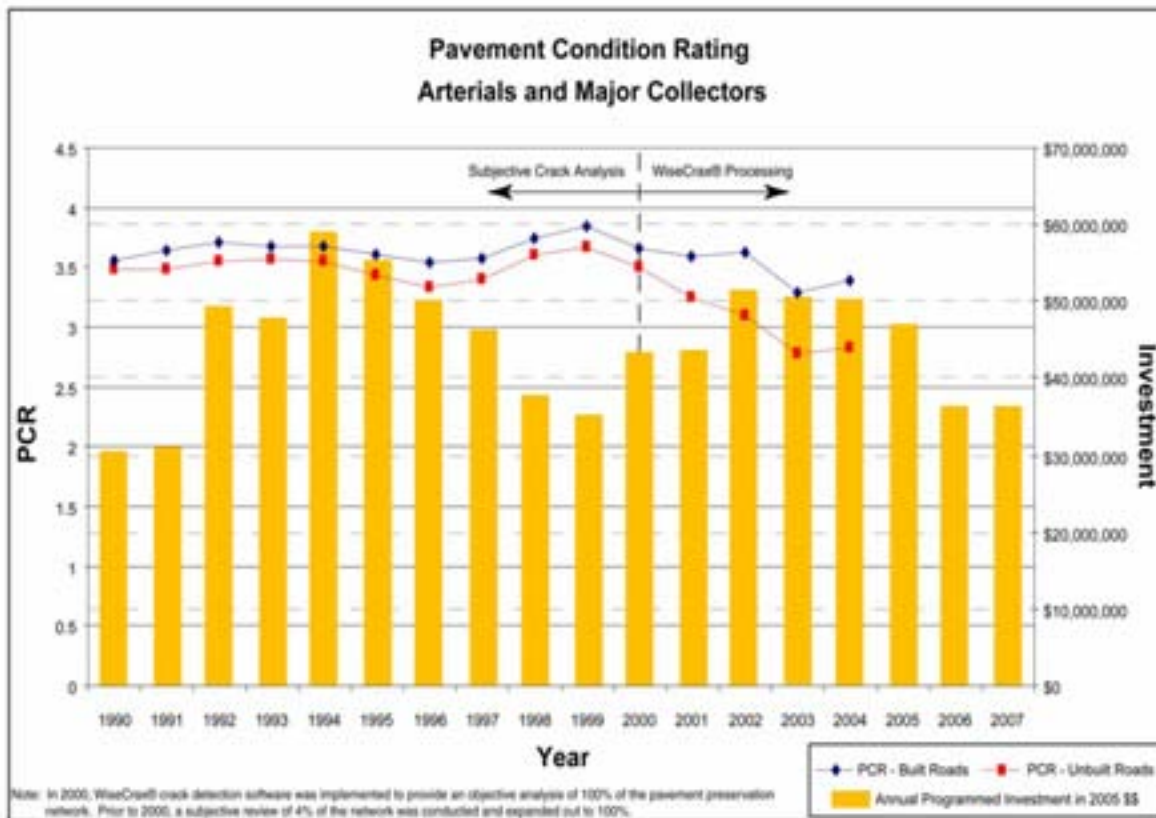
### 4.9 Pavement Condition Rating – Built Roads



The average pavement conditions network-wide remained relatively constant throughout the 1990's. There was a slight upward trend in PCRs from 1996-1997 through 1999-2000, but over the last 6 years the average PCR values have decreased. This deterioration of PCR is illustrated across all Federal Functional Classes, but is most noticeable in the minor arterial and major collector classes.

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### 4.10 Pavement Condition Rating



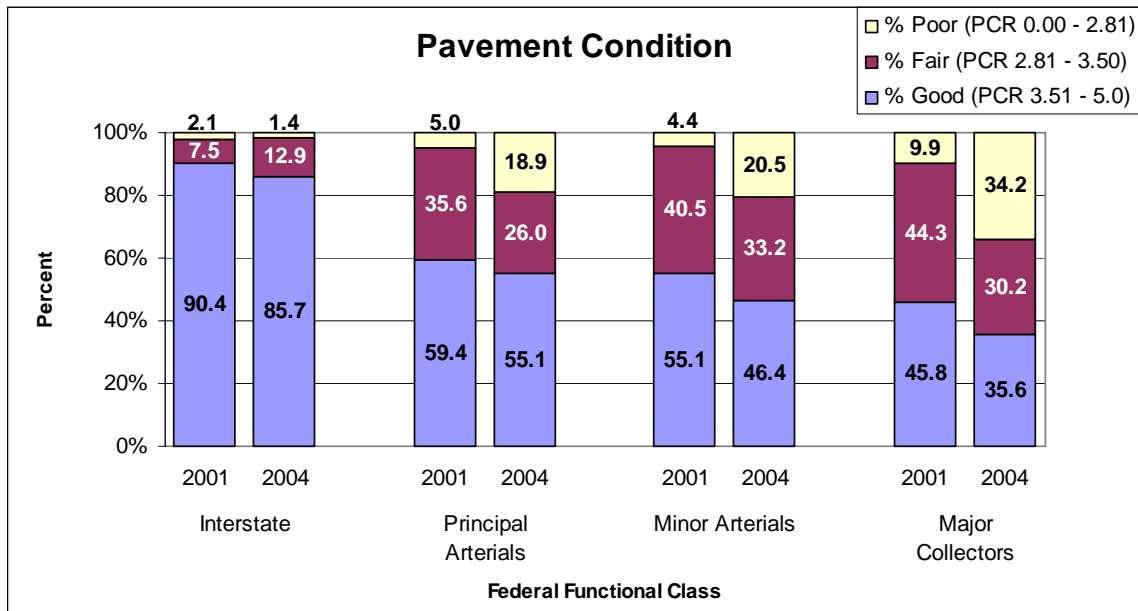
There are a number of likely reasons for this. It may be the result of several years of inconsistent funding of the pavement preservation program. This is illustrated in figure 4.10 which shows the annual programmed investment versus measured PCR for built and unbuilt arterials and major collectors.

Low and high network pavement condition ratings are seen approximately 4 to 5 years after lower and higher levels of funding respectively. Another factor that likely contributes to this decrease in average network condition is the increased cost of construction due to the volatility being experienced in the petroleum markets. This affects the cost of asphalt and fuel required to operate construction equipment.

The system of built roads is where the principles of pavement preservation are applied. MaineDOT's pavement management philosophy is to maintain the condition of the built system before expending resources to reconstruct the unbuilt portion of the system. This has proven to be a more cost effective method of maintaining the system than the concept of 'worst first', which would dictate fixing the worst roads in the system first, and not treating the 'better' roads. The philosophy of pavement management, sometimes called pavement preventive maintenance, is to maintain the condition of the built roads at good or very good condition, and to upgrade the unbuilt system as funding allows. Though many factors influence pavement deterioration, and are considered in the process, PCR is a key indicator on the built system to determine the optimum time to treat a particular section of road. It is generally most cost effective to treat a roadway before the PCR drops below a 3.0. More miles of roadway can be treated at a lower dollar cost per mile, thus maintaining the integrity of the system as a whole. MaineDOT's pavement management application, dTIMS CT, performs life-cycle cost analysis for a variety of treatment scenarios to help determine the right treatment at the right time with the highest return on investment. The following graph shows the condition of the State's highway network as a percentage of good, fair, or poor condition.

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### 4.11 Pavement Condition



2004 Data based on 2003-2004 data of roads collected for pavement management purposes. 2001 Data as reported in the State of the System Report, November 2002.

The following images depict examples of Good, Fair and Poor pavements:

**Good = PCR 3.51 - 5.0**



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Fair = PCR 2.81 - 3.50



Poor = PCR 0.0 - 2.80



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### 4.3.4 Posted Roads:

MaineDOT has the right and responsibility to limit the weight of trucks and vehicles operating on State and State Aid Highways per Title 29-A, Maine Revised Statutes Annotated, in order to protect roads from potential damage. Posting of roads typically occurs in late winter/early spring when the temperature regularly goes above freezing and the roadways start to thaw. Many unbuilt roads with good free draining gravel material as a roadway base and that are showing signs of distress, are posted with a weight limit to prevent further damage from heavy vehicles. These roads are posted to prevent vehicles with a registered weight over 23,000 pounds from hauling over them when the vehicles are loaded and the roadway is not frozen. If the air temperature is 32 degrees Fahrenheit, or less with no visible water on the roadway, then trucks over 23,000 pounds are allowed to haul their loads over the roadway. Passenger cars, pickup trucks and emergency vehicles are exempt from these regulations. Any vehicle transporting home heating fuel (oil, gas, coal, stove size wood) to a private consumer, gasoline, groceries, bulk milk, bulk feed, solid waste, rubbish or medical gases may apply for an exemption certificate. These vehicles must be registered when in excess of 23,000 pounds and must be carrying a partial load with a weight equal to or less than that indicated on an exemption certificate issued by the MaineDOT. The impact of posted roads on the State's economy is significant, affecting commercial and industrial interests throughout the state. The following figure lists the centerline miles of posted roads per region in the spring of 2005 by Federal Functional Classification.

**4.12 Centerline Miles of Posted Roads**

REGION	MINOR COLLECTOR	MAJOR COLLECTOR	MINOR ARTERIAL	PRINCIPAL ARTERIAL
SOUTHERN	6		8	
MID COAST	37	20		
WESTERN	293	428		
EASTERN	483	232	8	
NORTHERN	283	56		
TOTALS	1102	736	16	

To remedy the need to post roads would require rebuilding the roadway base and pavement structure. A rough estimate to accomplish this rebuild of 1854 miles of posted roads would be approximately \$600,000 per centerline mile of roadway or \$1,112,400,000 to improve all roads typically posted in the spring.

### 4.3.5 Roadway Attributes:

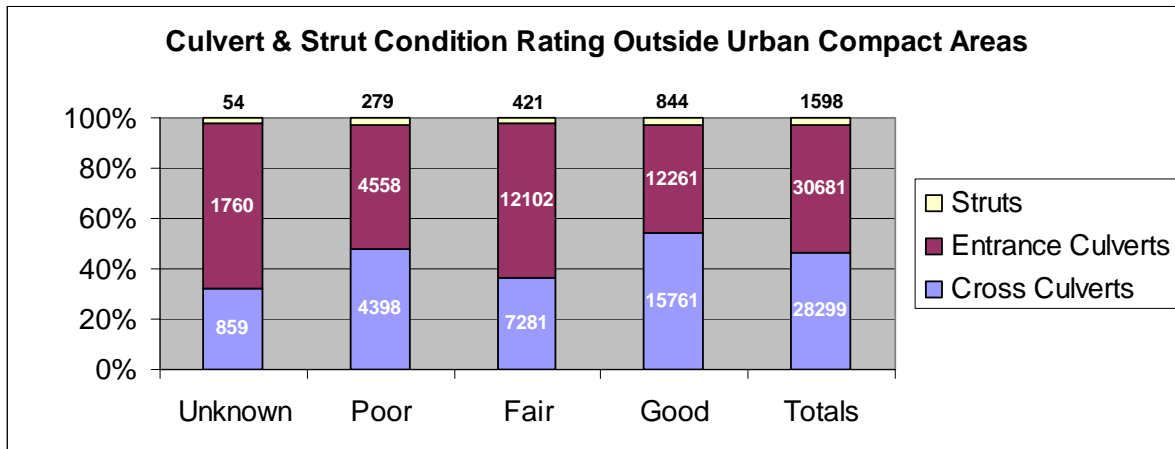
The Department is currently utilizing and further developing an asset management tool called the Asset Inventory Management System (AIMS). AIMS is a database of roadway attributes and currently contains a description of the asset as well as the location and condition data for each individual cross culvert, entrance culvert, strut (generally a pipe between 5 feet and 10 feet in diameter), guardrail, catch basins, Department owned property & buildings and major & minor signs that are the MaineDOT's responsibility throughout the state. Information regarding the Maintenance Crew that is responsible for each asset is also included. The purpose of the tool is to help monitor the condition of the various roadway attributes and to plan for required work or repairs on these attributes. From this database we can pull the information regarding the total number of the various attributes as well as the general condition to help determine an approximate need to bring them up to a "good" condition rating. On the following is a figure outlining the total number of the various roadway attributes.

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### 4.13 Number of the Various Roadway Attributes

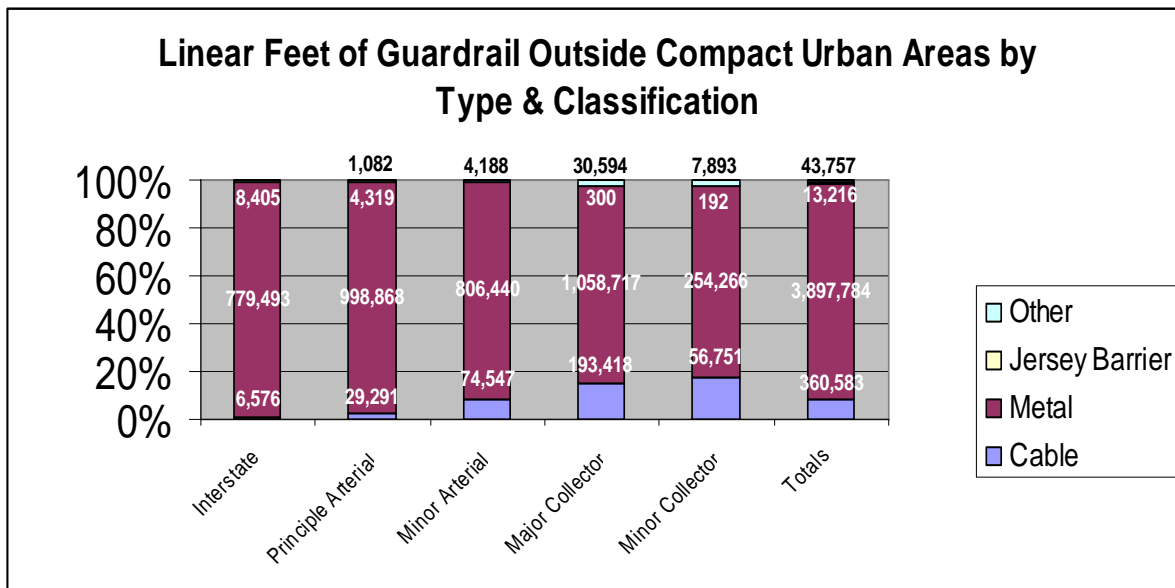
ROADWAY ATTRIBUTE	TOTAL OUTSIDE URBAN COMPACT AREAS
Cross Culverts	27,459
Entrance Culverts	28,400
Struts	1,590
Guardrail	4,315,340 Linear Feet

### 4.14 Attribute Condition Chart 1



A rough estimate to bring all fair and poor culverts up to a good condition rating would be approximately \$1,200 per culvert for 27,459 culverts or approximately \$27,776,400 to bring these culverts outside the Urban Compact Areas up to good condition.

### 4.15 Attribute Condition Chart 2



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### 4.4 Highway Use

Measurements of the use of the highway system are an indication of the demands that are being placed on the system by its users: people who need to travel or move goods across the state. The following describes some key measures of highway use.

#### 4.4.1 Annual Average Daily Traffic

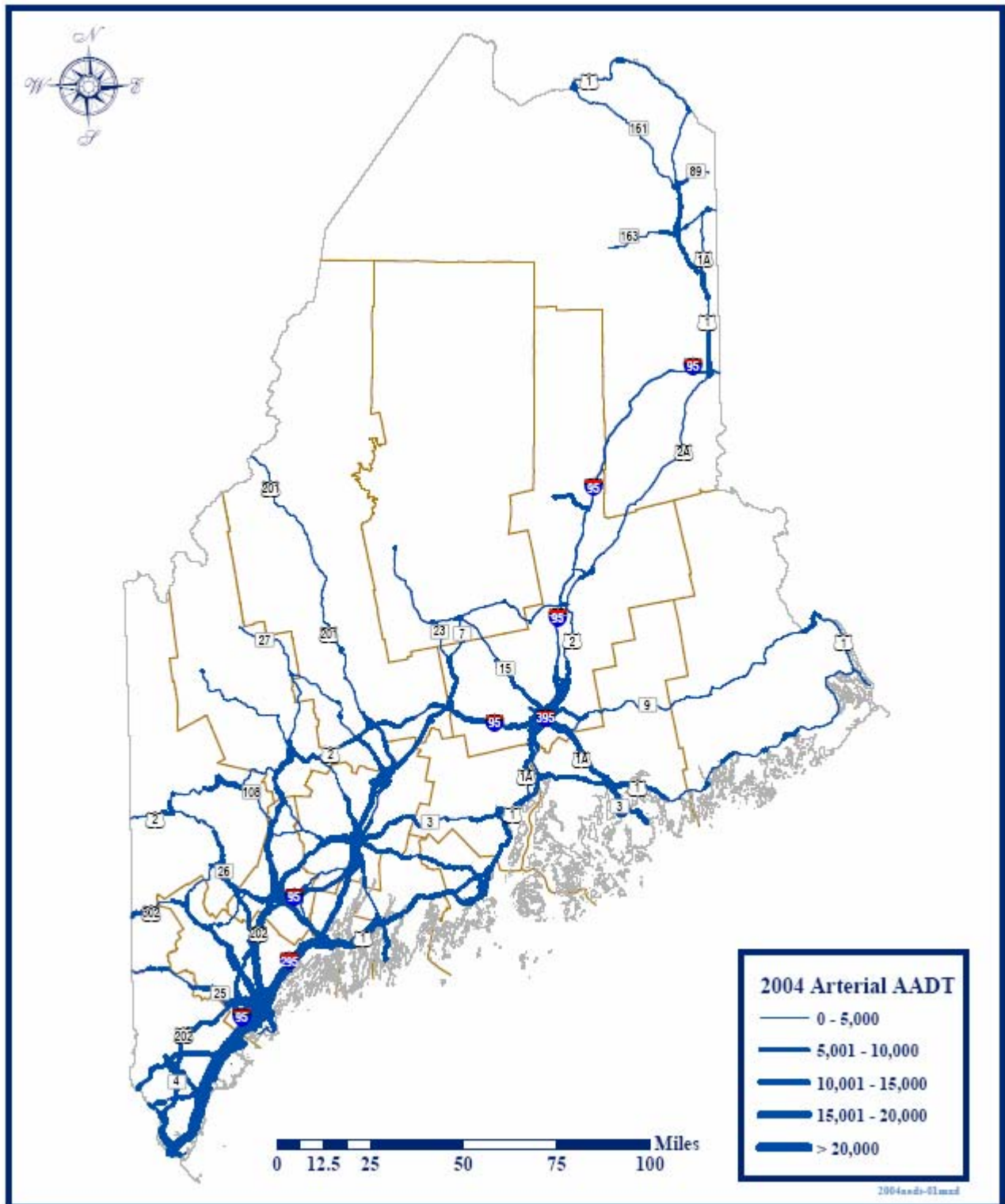
The most basic measure of the use of a highway is Annual Average Daily Traffic (AADT), the total number of vehicles that pass a location on a roadway in one year, divided by 365. Estimates of AADT are used in the planning, design, and management of highway facilities. AADT is the measure used to track historic traffic growth and forecast future traffic growth at specific locations on the highway system. AADT is an important component of the measurements of highway safety and mobility performance. Existing and forecasted AADT also helps determine appropriate design standards for highways and bridges.

The statewide map in the following figure shows the relative AADT volumes on the arterial highways in Maine. Most of the higher volume arterials are in the southern half of the state. Interstate 95 and other arterials across the state are the backbone of Maine's highway network.



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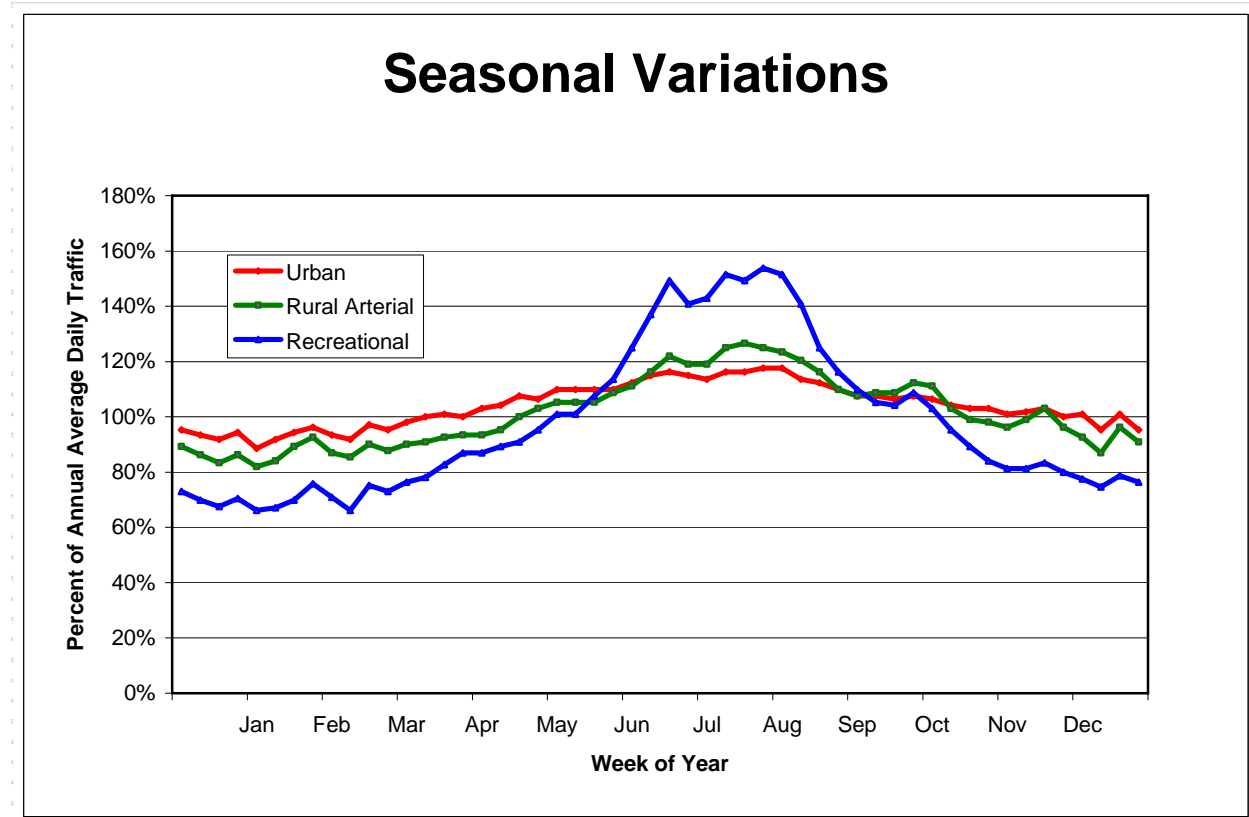
### 4.16 Statewide AADT



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While AADT represents an annual average, daily traffic varies seasonally throughout the year. Figure 4.14 shows how traffic levels change from month to month based on highway type. These patterns show higher traffic volumes in the summer months and lower volumes in the winter months. The strongest pattern change is shown for highways with recreational traffic heavily affected by the summer peak in tourism. The most uniform pattern exists in urban locations and many suburban areas, which are dominated by commuting and other local traffic. The intermediate pattern change is typical of many rural arterial highways, which have a balanced mix of tourism and year-round traffic.

4.17 Seasonal Variation in Traffic



### 4.4.2 Vehicle-Miles Traveled

Vehicle-Miles Traveled (VMT) is the principal measure of the overall use of the highway system. In the year 2004, statewide VMT was nearly 15 billion vehicle-miles. As an overall measure of use of the highway system, VMT is useful in tracking growth in highway travel, which affects overall system condition, performance, fuel use and air quality.

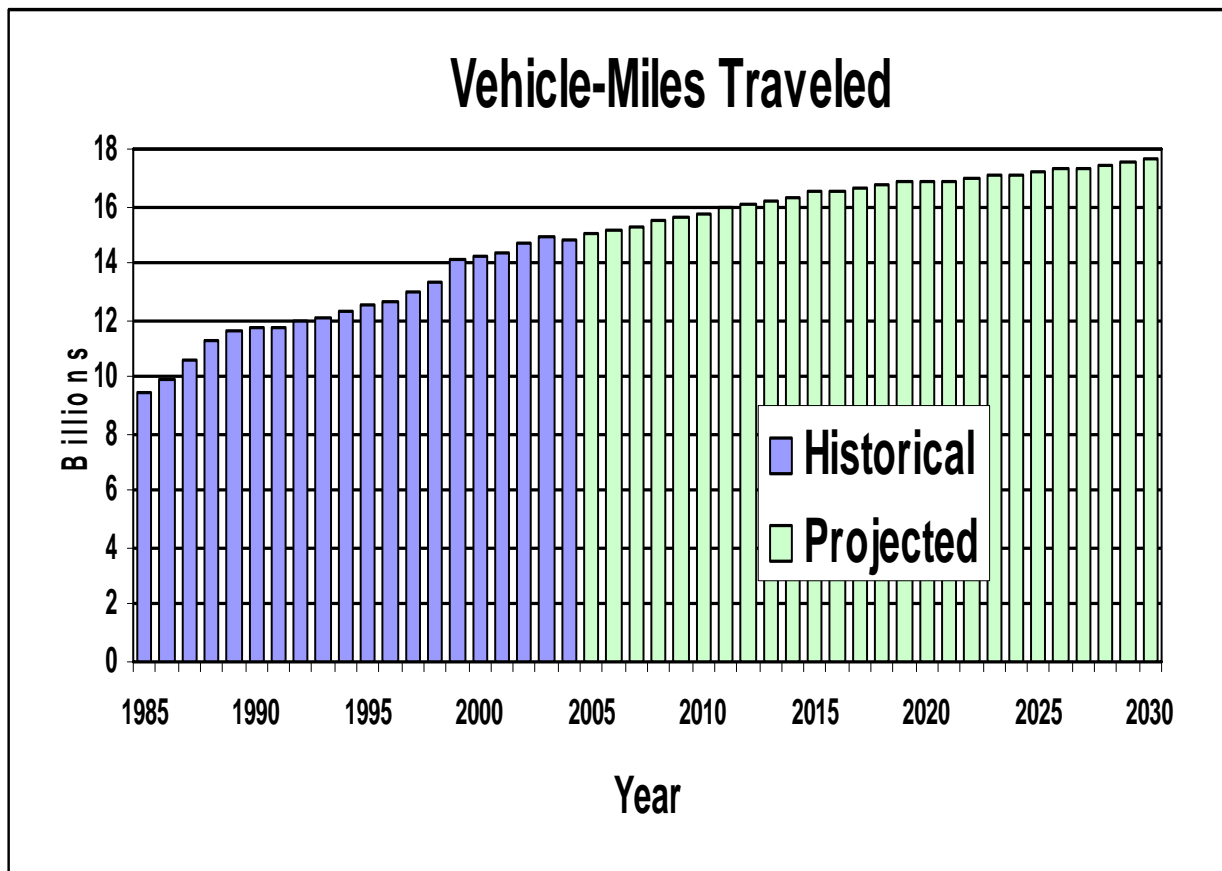
Figure 4.18 shows how statewide VMT has been growing through the years, with periods of slow and more rapid growth. Continued growth in VMT is expected in the foreseeable future, but it may occur at a slower pace than historic trends.

A further breakdown of statewide VMT in 2004 is shown in figure 4.19. Light vehicles, which include passenger cars, light trucks, and motorcycles, account for approximately 93% of the VMT on the highway system. Tractor-trailers and single-unit heavy trucks, about 7% of the VMT overall, are over 10% of the traffic on the Interstate highways. Arterials (principal and minor) carry 61% of the VMT.

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Travel in rural areas accounts for 74% of the VMT. This high percentage of VMT can be attributed to the fact that Maine has a substantial rural population and that the low population density of rural areas means traffic generated in rural areas must travel greater distances than traffic generated in urban areas. Long-distance travel, whether generated in urban or rural areas, passes through mostly rural areas.

4.18 Trends in Statewide VMT



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### 4.19 2004 VMT by Vehicle Type and Federal Functional Class

Area Type	Federal Functional Class	Light Vehicle	Single Unit Truck	Tractor-Trailer	VMT (billion)	Percent of Grand Total
Urban	Local	96%	4%	0%	0.3	2%
	Urban collector	95%	4%	2%	0.7	5%
	Minor arterial	95%	3%	2%	1.0	7%
	Other Principal arterial	95%	3%	2%	1.0	6%
	Principal art interstate	90%	4%	6%	0.7	5%
	Principal art other F&E	93%	3%	4%	0.2	1%
	Urban Total	94%	3%	3%	3.9	26%
Rural	Local	94%	6%	0%	1.3	9%
	Major collector	96%	2%	2%	2.5	17%
	Minor arterial	91%	5%	4%	1.9	13%
	Minor collector	92%	5%	3%	0.9	6%
	Other Principal arterial	91%	4%	5%	2.0	13%
	Principal art interstate	89%	5%	6%	2.5	17%
	Rural Total	92%	5%	3%	11.1	74%
<b>Grand Total</b>		<b>93%</b>	<b>4%</b>	<b>3%</b>	<b>15.0</b>	<b>100%</b>

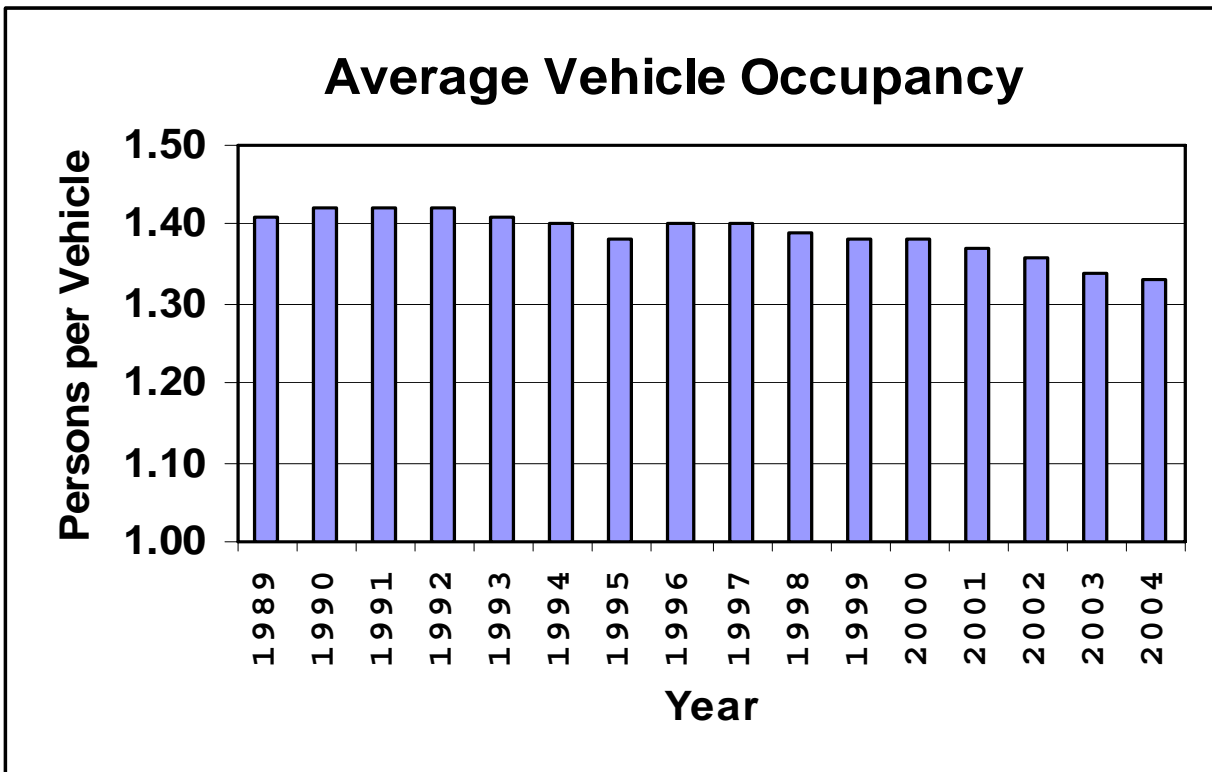
#### 4.4.3 Average Vehicle Occupancy

Average Vehicle Occupancy (AVO) is the average number of occupants (driver and passengers) in vehicles on the highway. This indicator is used to convert vehicle-based measures, such as VMT, to person-based measures, such as Person-Miles Traveled (PMT). AVO is estimated from data compiled in thousands of crash records each year.

The trend shown in figure 4.20 indicates how the statewide AVO has been slowly decreasing. This slow decrease may be the result of dispersed patterns of land development, reduced household size, reduced carpooling, and increased levels of auto ownership.

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4.20 Trend in Average Vehicle Occupancy



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### 4.5 Mobility

Mobility is the ability of people and goods to move from one place to another. The arterials in the highway system provide most of the mobility in Maine. While only representing 12% of the road mileage, arterials account for more than 60% of VMT statewide. For this reason, the performance of the arterials, in serving the mobility needs of the state, is an important part of the system evaluation. The following describes key indicators of highway mobility and performance.

#### 4.5.1 Posted Speed

The speed limit (posted speed) of a highway is an important indicator of the facility's potential to provide mobility. Roads with higher posted speeds can serve the movement of people and goods more efficiently than low-speed roads.

Interstate highways, other principal arterials, and minor arterials account for more than 3,000 miles of Maine's road network. Figure 3.21 shows a percentage breakdown of arterial mileage by posted speed. Half of Maine's arterial mileage is posted at 55 mph or higher.

**4.21 Arterial Mileage by Posted Speed**

Posted Speed	Mileage	Percentage
65	727	23%
60	0	0%
55	883	28%
50	593	19%
45	282	9%
40	139	4%
35	214	7%
30	110	3%
25	210	7%
<b>Total</b>	<b>3157</b>	<b>100%</b>

Posted speeds vary by functional class and area type. Higher functional classes tend to have higher posted speeds. Also, roads in rural areas generally have higher posted speeds than in urban areas. Figure 4.22 shows the average posted speed of urban and rural functional classes of arterials, weighted by mileage in each class. With posted speeds that are generally 65 mph, rural Interstate highways provide the highest level of highway mobility in Maine. At the other extreme, minor arterials in urban areas have an average posted speed around 30 mph.

**4.22 Average Posted Speed by Functional Class**

Functional Class	Average Posted Speed	
	Urban	Rural
Interstate & Expressway	52.9	64.1
Other Principal Arterial	32.6	47.2
Minor Arterial	30.6	45.6

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### 4.5.2 Utilization of Capacity

In addition to posted speed, AADT and hourly highway capacity (C) are important factors in the measurement of mobility. While AADT is a measure of use, C is the maximum number of vehicles that can pass by a location in a single hour. When AADT is divided by C, the AADT/C ratio measures how intensely a highway is utilized. If traffic volumes increase over time but the capacity remains the same, the AADT/C also increases. As a highway facility's AADT/C ratio increases, the average speed of vehicles on that facility tends to decrease. This decrease in average speed provides evidence of reduced mobility.

Figure 4.23 shows a breakdown of arterial mileage by area type and by ranges of AADT/C, based on volume data for the year 2004. About 75% of all arterials are in the low and very low ranges of AADT/C, where the traffic-carrying capacity of the roadway is never challenged. Less than 3% of the mileage is in the high or very high ranges where capacity is routinely reached. Most urban mileage is in the low, moderate, or moderately high ranges of AADT/C. The majority of rural mileage is in the low or very low ranges.

**4.23 Arterial Mileage in 2004 by AADT/C Range**

Range of AADT/C	Operates at Capacity(Typ.)	Urban	Rural	Total	Percentage
Very Low (0-2)	never	63	1,256	1,319	42.0%
Low (2-4)	never	152	895	1,047	33.3%
Moderate (4-6)	rarely in peak hours	172	281	454	14.5%
Moderately High (6-8)	seasonally in peak hours	121	110	231	7.4%
High (8-10)	routinely in peak hours	44	30	74	2.3%
Very High (> 10)	for prolonged peak periods	14	1	15	0.5%

Figure 4.24 shows the average AADT/C ratios for functional classes of urban and rural arterials. As indicated, the arterials in urban areas are more heavily utilized than rural arterials. Among the functional classes, Interstate and expressway mileage has lower utilization of capacity than other arterial classes, mainly due to their ability to carry relatively large numbers of vehicles (close to 2,000 vehicles/lane/hour). This high capacity is made possible by multiple lanes, full control of access, and a median to separate the two directions of traffic flow. Other principal arterials, with their high transportation importance and lower capacity (often less than 1,000 vehicles/lane/hour), have the heaviest utilization of capacity.

**4.24 Average AADT/C by Functional Class**

Functional Class	Average AADT/C	
	Urban	Rural
Interstate & Expressway	3.82	2.93
Other Principal Arterial	5.61	2.92
Minor Arterial	5.62	2.37

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As traffic volumes increase between years 2004 and 2030, average AADT/C ratios can be expected to increase by about 20%. Figure 4.40 shows the projected breakdown of arterial mileage by AADT/C range in 2030 if no changes are made to the arterial network. A comparison of figure 4.40 with figure 4.25 shows the likely shift to the higher ranges of AADT/C. The amount of arterial mileage in the very high range could increase more than fourfold, from 15 to 70 miles. Mileage in the high range could nearly double, going from 74 miles to 135 miles. At the other end of the spectrum, mileage in the low and very low ranges could decrease by about 250 miles.

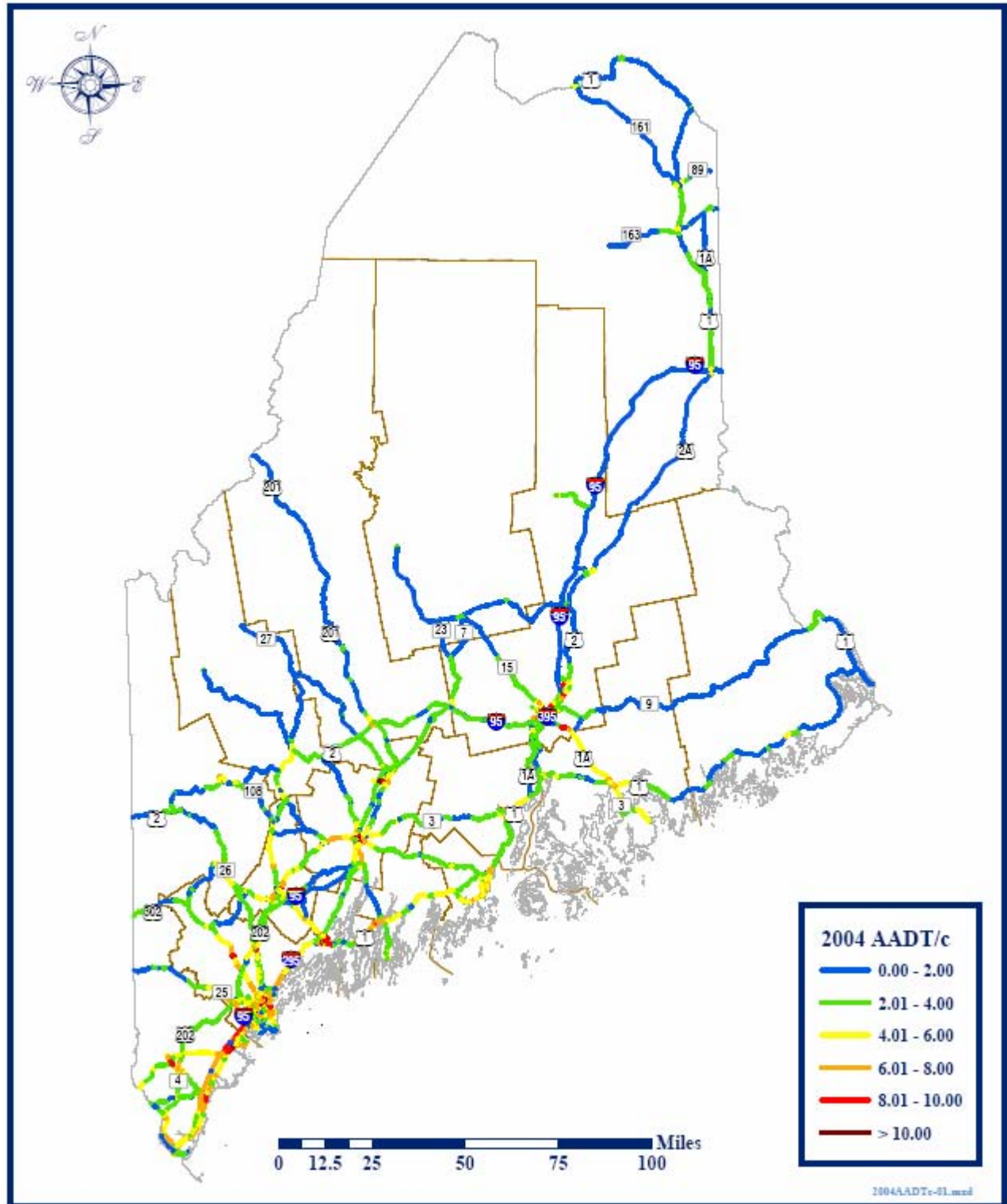
**4.25 Arterial Mileage in 2030 by AADT/C Range**

Range of AADT/C	Operates at Capacity (Typ.)	Urban	Rural	Total	Percentage
Very Low (0-2)	never	41	1072	1113	36%
Low (2-4)	never	119	876	995	32%
Moderate (4-6)	rarely in peak hours	146	374	520	17%
Moderately High (6-8)	seasonally in peak hours	141	159	301	10%
High (8-10)	routinely in peak hours	72	62	134	4%
Very High (> 10)	for prolonged peak periods	46	24	70	2%

The potential increase in the utilization of arterial capacity could lead to more arterial miles being pushed to the limits of their capacity more often. These strains on capacity would lead to increased levels of traffic congestion on arterials in the future. Figures 4.26 and 4.27 shows the capacity utilization of the Maine arterial network in 2004 and the potential utilization by 2030, respectively. The increasing demands on capacity are evidenced by the spread of the red and orange levels of utilization on arterials in the southern and central regions of the state, an indication that additional highway capacity will be needed in the future.

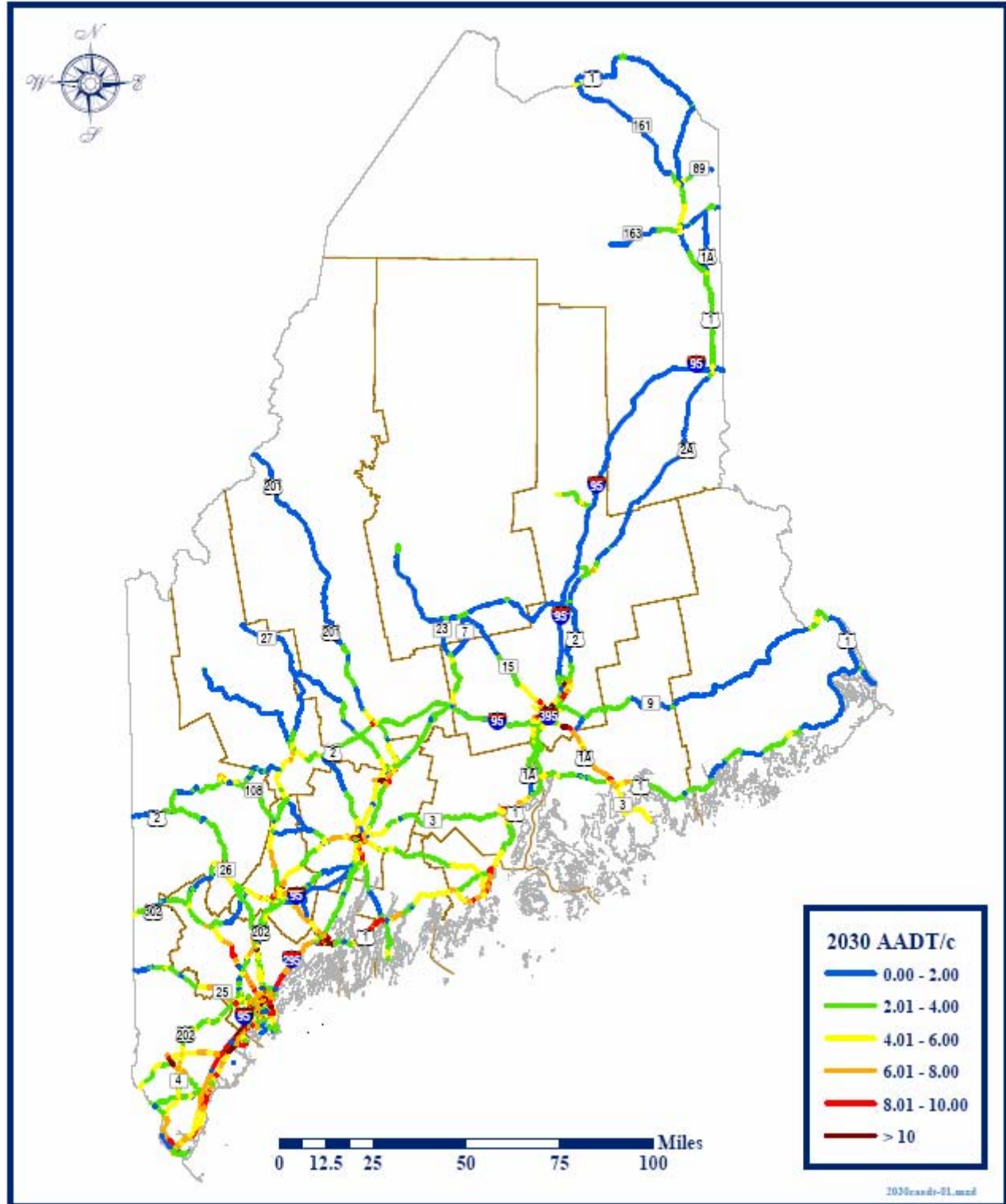
## 4.0 Highways

### 4.26 AADT/C on Arterials 2004



## 4.0 Highways

### 4.27 AADT/C on Arterials in 2030



## 4.0 Highways

### 4.5.3 System Efficiency - VHT and Delay

While vehicle-miles traveled (VMT) is an overall measure of travel on the highway system, an overall measure of the amount time spent traveling is vehicle-hours traveled (VHT). Because time has value, evaluation of VHT allows the estimation of travel time costs and benefits.

Ideally, travel would be free flowing for all travelers. However, on our arterial network, the presence of many travelers creates interference in the free flow of traffic. As a result, travel speeds decline and travel times increase. The increase in travel time caused by the interference among vehicles is called delay, which can be considered as the excess travel time due to traffic interference (congestion). Delay is an added cost to the traveler. If actions are taken to reduce delay in the highway network, these reductions in delay are considered to be mobility benefits of the actions.

An indicator of the congestion level of a highway facility is the travel time ratio. This ratio equals total VHT divided by the free flow VHT (VHT with no delay). A travel time ratio of 1.25 indicates that delay increases travel time by 25%. Total VHT, travel time ratios and delay are shown for various arterial classes in figure 4.428. Also shown in figure 4.43 are total VHT, delay, and delay costs broken down by arterial class. Urban arterials account for most of the delay costs.

**4.28 VHT and Delay in 2004 by Functional Class**

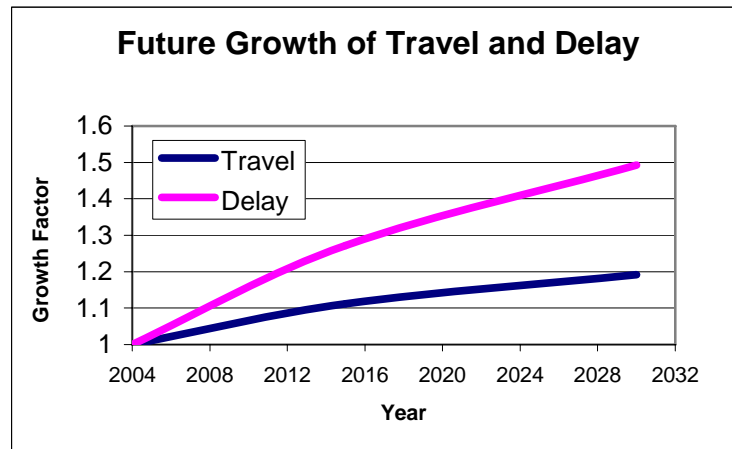
Area Type	Functional Class	Total VHT (millions)	% of VHT	Travel Time Ratio	Delay VHT (millions)	Delay Costs (\$millions)	% of Delay
Urban	Interstate & Expressway	12.9	5%	1.04	0.5	6	1%
	Other Principal Arterial	35.5	16%	1.49	11.7	131	30%
	Minor Arterial	43.1	20%	1.54	15.0	164	38%
Rural	Interstate & Expressway	39.0	18%	1.03	1.2	17	4%
	Other Principal Arterial	44.8	20%	1.14	5.6	65	15%
	Minor Arterial	42.7	19%	1.12	4.6	54	12%
<b>Combined Total</b>		<b>219.4</b>	<b>100%</b>	<b>1.21</b>	<b>38.7</b>	<b>438</b>	<b>100%</b>

Overall, it is estimated that delay on Maine's arterials in 2004 exceeded 38 million vehicle-hours, with delay cost of more than \$400 million dollars. Although rural arterials have more VHT, most of the delay occurs on urban non-Interstate arterials where capacity is limited, traffic volumes are high, and land use access is generally uncontrolled.

Figure 4.29 shows the effect of future travel growth in delay in the arterial network (with no mobility improvements). As the future trends show, the growth in delay, measured in VHT, far exceeds the growth in travel, measured in vehicle-miles (VMT). Between 2004 and 2030, delay is expected to grow at two and a half times the rate of growth in travel. When the growth of delay exceeds the growth in travel, the traveler experiences higher levels of congestion and reduced travel efficiency.

## 4.0 Highways

### 4.29 Future growth of travel delay



To moderate the growth of delay, actions must be taken to reduce VMT growth, improve control of access on arterials, and/or increase future capacity in the arterial network. If these actions are successful in holding the growth in delay to the same rate as the growth in travel, then current levels of congestion and mobility experienced by the traveler can be maintained.

## 4.0 Highways

### 4.6 Highway Funding Scenarios And Implications

For highway conditions, the Department's highway expenditures are broken up into three distinct categories: Highway Improvements, Pavement Preservation, and Maintenance Surface Treatment.

- Highway Improvement Projects are generally those projects done on an unbuilt (backlog) roadway in order to improve the condition of the road to meet current standards (adequate sight distance, drainage, safety, and structural capacity).
- Pavement Preservation treatments are applied to built roads to cost effectively keep good roads in good condition. MaineDOT maintains a set of tools that assist planners and designers in optimizing the effectiveness of pavement expenditures. The function of Pavement Management is to collect and analyze pavement condition data to improve the efficiency of decision-making and provide feedback on the consequences of decisions. This is accomplished by providing timely recommendations on treatment alternatives and locations, to protect the current investment in highways and to reduce user costs.
- Maintenance Surface Treatment, sometimes referred to as maintenance paving, is defined as paving that is done on unbuilt, or inadequate highways to keep those roads in a serviceable condition until such time as a more substantial treatment can be done. Maintenance paving does not generally address issues of drainage, sight distance, or structural adequacy.

#### 4.30 Summary of Highway Investments by BTIP

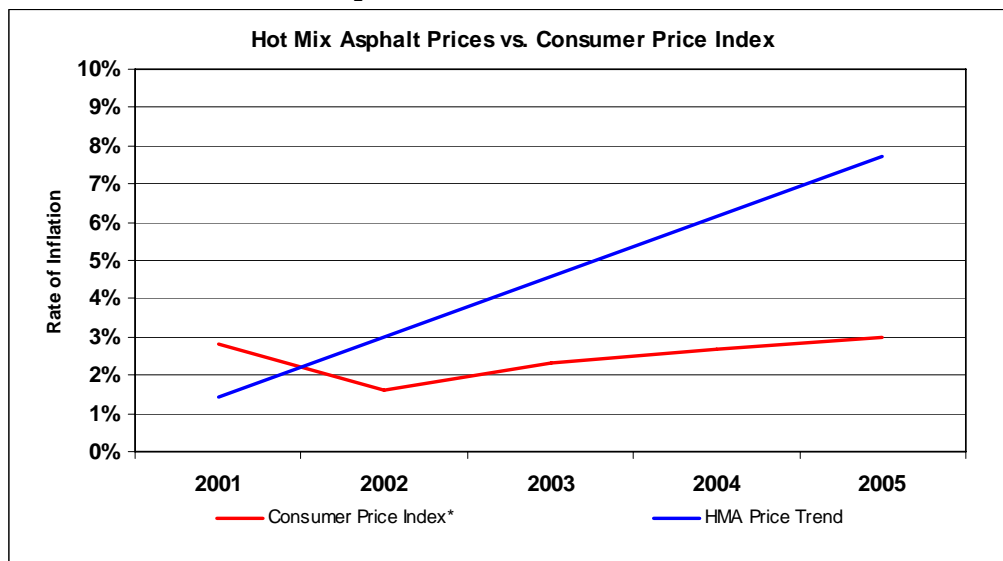
<i>(Cost in Millions of 2005 Dollars)</i>										
	1998-1999 BTIP		2000-2001 BTIP		2002-2003 BTIP		2004-2005 BTIP		2006-2007 BTIP	
	Miles	Cost	Miles	Cost	Miles	Cost	Miles	Cost	Miles	Cost
<i>Highway Improvements</i>										
Principal Arterial	30.8	\$57.1	22.9	\$38.8	28.1	\$43.3	46.1	\$38.7	31.9	\$39.0
Minor Arterial	39.4	\$36.5	20.2	\$25.6	27.5	\$32.3	64.7	\$36.4	42.5	\$45.4
Major Collector	36.4	\$25.1	101.4	\$50.4	110.8	\$77.4	91.3	\$51.0	183.2	\$53.7
Minor Collector	39.1	\$15.8	25.4	\$5.0	55.1	\$19.7	30.7	\$9.5	42.8	\$9.6
<b>Total Improvement</b>	<b>145.7</b>	<b>\$134.5</b>	<b>169.9</b>	<b>\$119.8</b>	<b>221.5</b>	<b>\$172.7</b>	<b>232.8</b>	<b>\$135.6</b>	<b>300.4</b>	<b>\$147.7</b>
<i>Pavement Preservation</i>										
Interstate	86.0	\$18.0	64.0	\$14.2	44.6	\$10.8	103.4	\$17.2	96.0	\$15.7
Principal Arterial	67.0	\$18.4	119.0	\$24.9	80.9	\$23.0	136.4	\$22.6	146.6	\$24.0
Minor Arterial	123.0	\$20.3	137.0	\$26.0	139.5	\$35.4	154.7	\$25.6	120.0	\$19.5
Major Collector	184.0	\$15.9	149.0	\$21.9	135.9	\$32.8	190.9	\$31.6	64.0	\$10.4
<b>Total Resurfacing</b>	<b>460.0</b>	<b>\$72.6</b>	<b>469.0</b>	<b>\$87.0</b>	<b>400.9</b>	<b>\$102.0</b>	<b>585.4</b>	<b>\$97.0</b>	<b>426.6</b>	<b>\$69.6</b>
<i>Maintenance Surface Treatment (MST)</i>										
<b>Total MST</b>	<b>1401</b>	<b>\$20.7</b>	<b>1436</b>	<b>\$16.8</b>	<b>1296</b>	<b>\$22.8</b>	<b>1450</b>	<b>\$30.3</b>	<b>1230</b>	<b>\$28.2</b>

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### 4.6.1 The Effects of Future Funding Levels and Inflation on Overall Network Condition

The Department recognizes the importance of accurately predicting the proper amount to spend on each of these treatment methods. We are working towards even more efficient pavement preventive maintenance, striving to do the right thing in the right place at the right time to maximize our return on investment. It is important to note, however, that the cost of construction materials has significantly outpaced the standard rate of inflation due in large part to increased asphalt and fuel costs. The following graph shows the upward trend of the average price per ton of hot mix asphalt (HMA) over the past 6 years compared to the Consumer Price Index (CPI).

**4.31 Hot Mix Asphalt Prices vs. Consumer Price index**



The decrease of 220 miles paved with Maintenance Surface Treatment between the 2004-05 BTIP and 2006-07 BTIP in table 4.30 is likely due in large part to the sharp increase in construction costs due to increased asphalt prices. In recent years, maintenance paving funds have also been used to do pavement preservation type treatments (STATE PPM) on built major collectors. This has proven to be a cost-effective means to extend the life of built major collectors.

Given the trends above alone, status quo funding for pavement preservation treatments will result in an overall deterioration in the condition of our pavements across the network.

### 4.6.2 Highway Improvement Needs

The needs for rural highway improvements within the state are quantified in table 4.32 below. The Department has a long history of investing to improve the State's highway system. However, the guiding resource allocation policy that the Department invests under states that MaineDOT maintain our existing system prior to investing in improvements, or expansion. Over the previous three biennia, the Department has invested an average of \$152 million dollars in Highway Improvements. This investment has resulted in the improvement of over 500 miles of highway.

**4.32 Cost to Construct Maine's Unbuilt Rural Arterials and Major Collectors**

Federal Functional Class	Rural Unbuilt Miles	Ave. \$ per Mile (to improve)	\$ to Improve All Rural Miles (millions)
Principal Arterials	78	\$2,900,000	\$226
Minor Arterials	117	\$1,600,000	\$187

## 4.0 Highways

Major Collectors	1542	\$700,000	\$1,079
<b>Total:</b>	<b>1737</b>	<b>\$859,400</b>	<b>\$1,493</b>

To achieve status quo performance from the highway system requires no additional investment for highway improvements. The traveling public would continue to operate on the existing 1,737 miles of unbuilt, or inadequate roadways with their related springtime weight postings. Given the economic impact of these postings and condition of the inadequate sections of roadway, this is not the strategic goal of the Department.

### Highway Investments:

**The Department must invest \$198 million per biennium for Highway Improvements, a 30% increase over status quo, in order to meet strategic goals.**

The funding scenarios table at the end of this executive summary estimates the strategic need of improving 195 miles of inadequate rural arterials within a 10 year timeframe. The total estimated cost of this initiative is over \$410 million. Over five biennia, this results in an average biennial investment of \$82 million. In the same 10 year time frame, the strategic need of negating all spring time weight restrictions on major collectors, a total of 736 miles is also estimated at a total cost of \$515 million

or a biennial investment of \$103 million. These strategic initiatives along with traditional investments in the minor collector system would require a \$198 million biennial investment in highway improvements which represents a 30% increase in funding.

### 4.6.3 Pavement Preservation Needs

Pavement Preservation Projects are those projects done on a built highway in order to preserve the condition of the pavement. This is accomplished through pavement preventive maintenance practices, which is the practice of first keeping “adequate” highways in good condition and then improving “inadequate” highways as funding allows. An “adequate” highway, for the purpose of Pavement Management and pavement preventive maintenance, is one that meets or exceeds structural and geometric standards. An “inadequate” highway fails to meet structural or geometric standards.

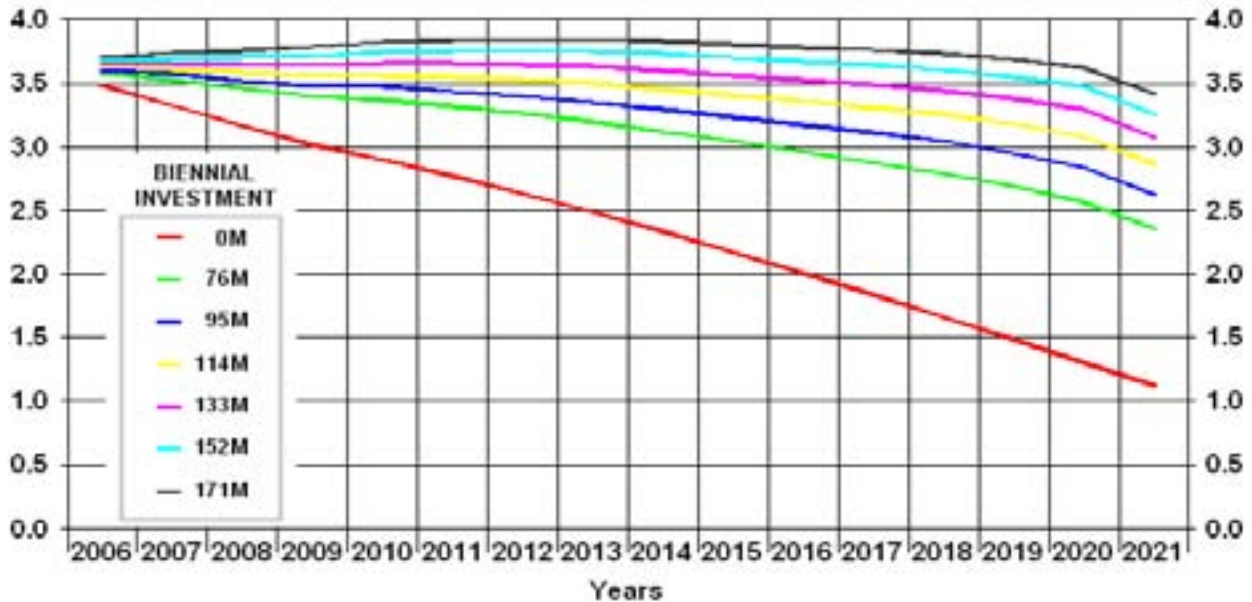
#### 4.33 Treatment Methods, Costs, and Life Expectancy

Treatment Type	Price per centerline mile	Expected Life
<b>BUILT ROADS</b>		
Crack Sealing	\$3,000 - \$7,000	2 Years
Overlay	\$110,000 (PPM) \$260,000 (Level 2)	8 – 10 Years
Reclaim/Overlay	\$425,000	12 – 15 Years
State PPM	\$50,000	6 – 8 Years
<b>UNBUILT ROADS</b>		
Maintenance Surface Treatment (Sand Mix)	\$26,500	4 – 6 Years
Collector Highway Improvement Project	\$500,000 – \$900,000	12 – 15 Years
Highway Improvement	\$1,600,000 - \$3,200,000	20 Years

## 4.0 Highways

The following graph shows the average network condition that could be expected on our built highways (arterials and major collectors including Metropolitan Planning Organization (MPO) areas) for various biennial funding levels:

**4.34 Average Condition for Built Arterial and Major Collectors**



**NOTE: The last treatment applied in these analyses is applied in 2020.**

For the last three BTIPs, the funding level for the pavement preservation program has averaged \$89.1 million per biennium. For analysis purposes, we consider \$95 million per biennium as our baseline or status quo funding scenario. To evaluate the effects of changes in the funding of the pavement preservation program, seven additional funding scenarios were developed, two of which are described in detail below. The reduced funding scenario of \$76 million per biennium represents a reduced funding scenario that is 20% below status quo, and the increased funding scenario of \$114 million per biennium represents a scenario that is 20% above status quo funding.

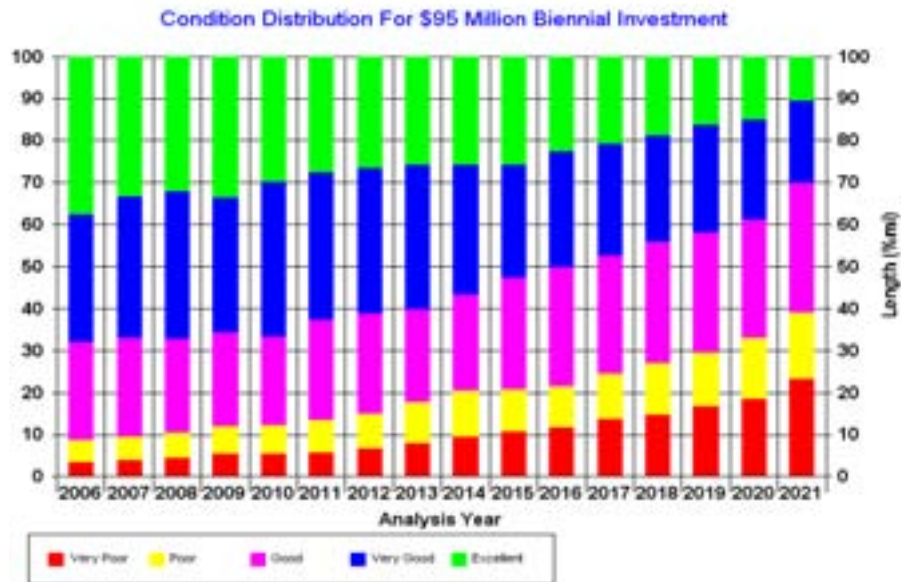
The pavement management analyses for status quo, increased, and decreased funding scenarios were conducted using a treatment cost inflation rate of 3%, and a life-cycle cost analysis discount rate of 4%.

## 4.0 Highways

### Status Quo Funding (\$95 Million per biennium)

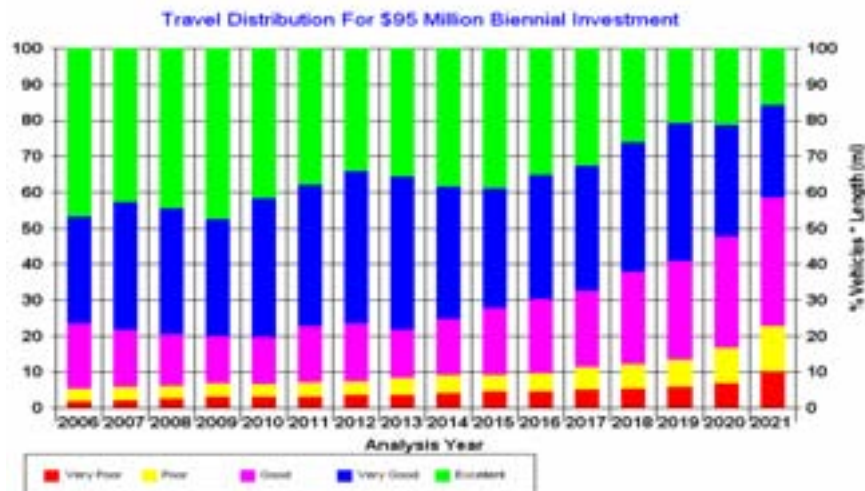
The following chart shows the average network condition distribution over time for built arterial and major collector highways that can be anticipated if funding were held at this level:

#### 4.35 Condition Distribution for \$95 Million Biennial Investment



A travel distribution chart was also developed for this same investment level. This chart factors in traffic data for each roadway to show the pavement condition distribution weighted by traffic.

#### 4.36 Travel Distribution for \$95 Million Biennial Investment



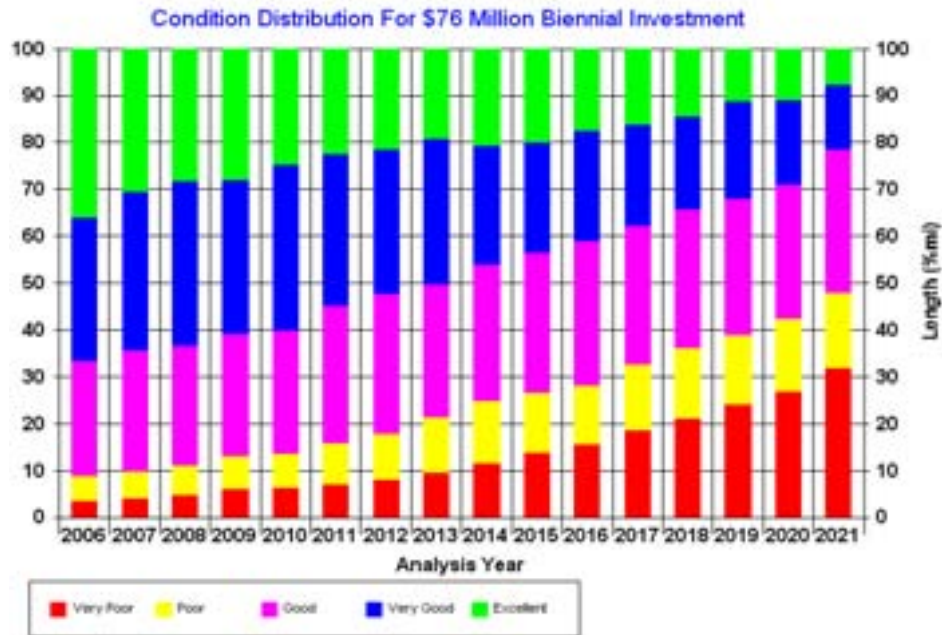
Both of these charts show a steady decrease in overall network pavement condition rating over time at this funding level, with the highest levels of investment being made on the arterial and interstate system, our most heavily-traveled highway systems.

## 4.0 Highways

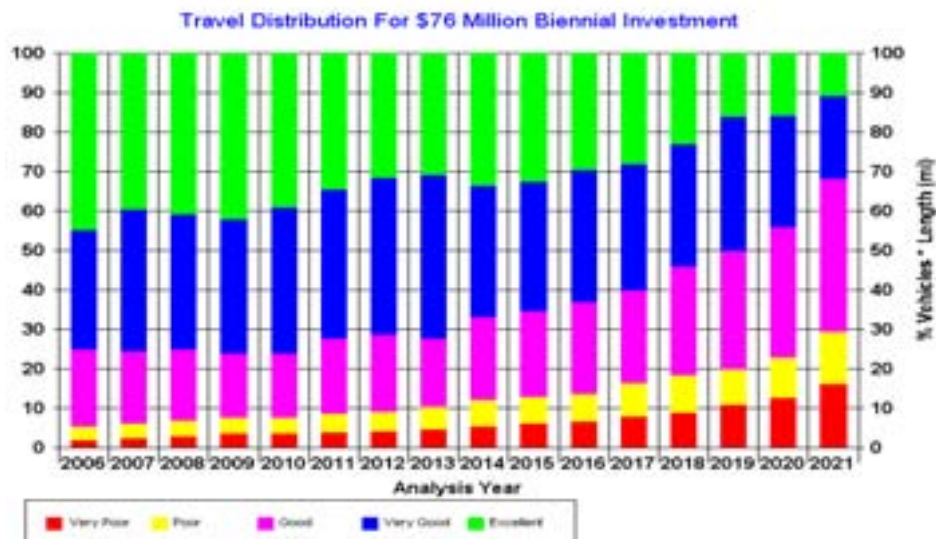
### Reduced funding (\$76 million per biennium)

The following charts show the average network condition distribution and travel distributions over time for built arterial and major collector highways that can be anticipated if status quo funding were reduced by 20%:

**4.37 Condition Distribution for \$76 Million Biennial Investment**



**4.38 Travel Distribution for \$76 Million Biennial Investment**



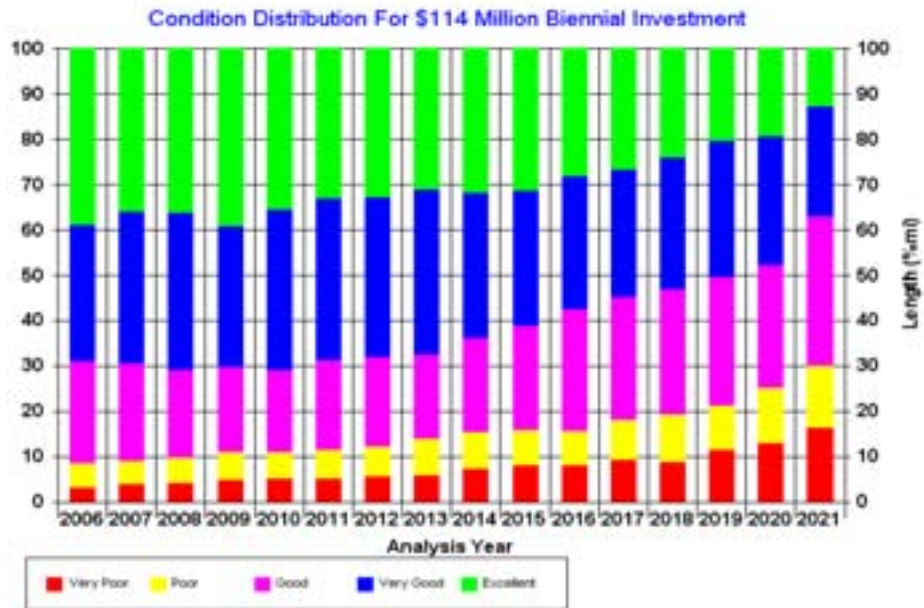
These charts show the accelerated deterioration of average network condition that would result from this investment level.

## 4.0 Highways

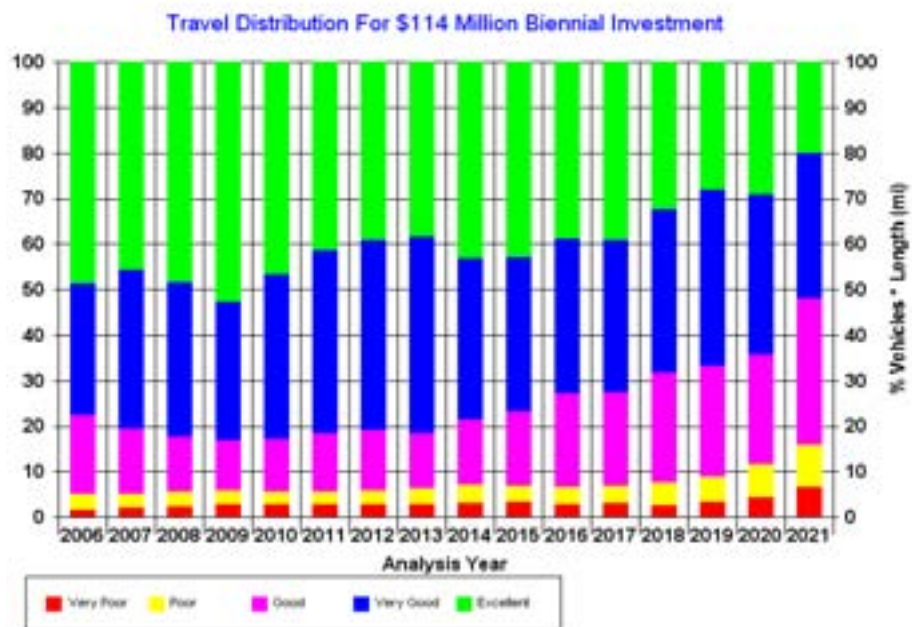
### Increased Funding (\$114 million per biennium)

The following charts show the average network condition distribution and travel distributions over time for built arterial and major collector highways that can be anticipated if status quo funding were increased by 20%:

**4.39 Condition Distribution for \$114 Million Biennial Investment**



**4.40 Travel Distribution for \$114 Million Biennial Investment**



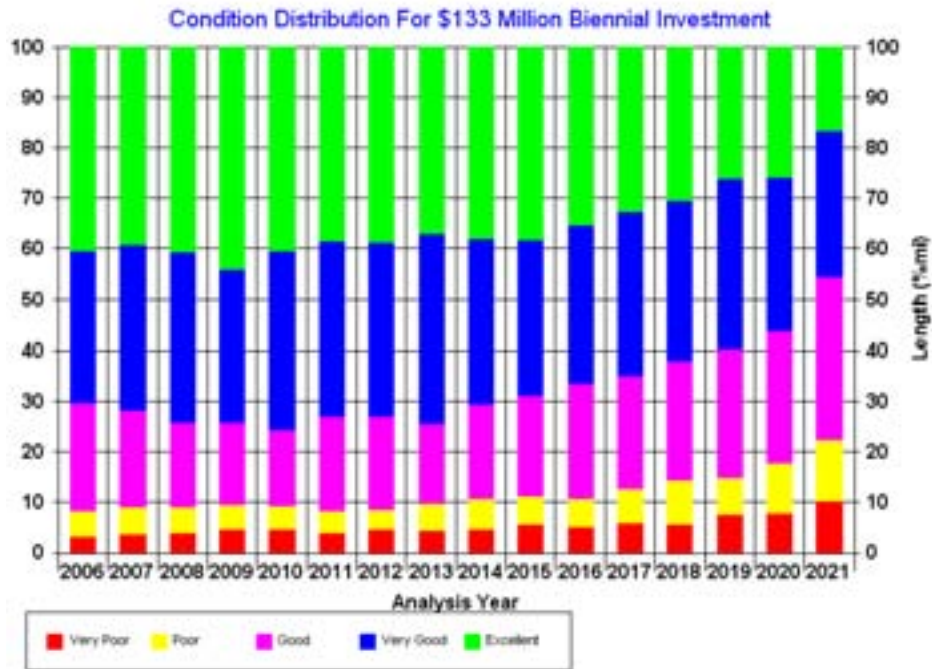
This investment level would begin to stabilize the deterioration of those roadway miles most heavily traveled, but still would result in a steady decrease in condition of our built major collector road system.

## 4.0 Highways

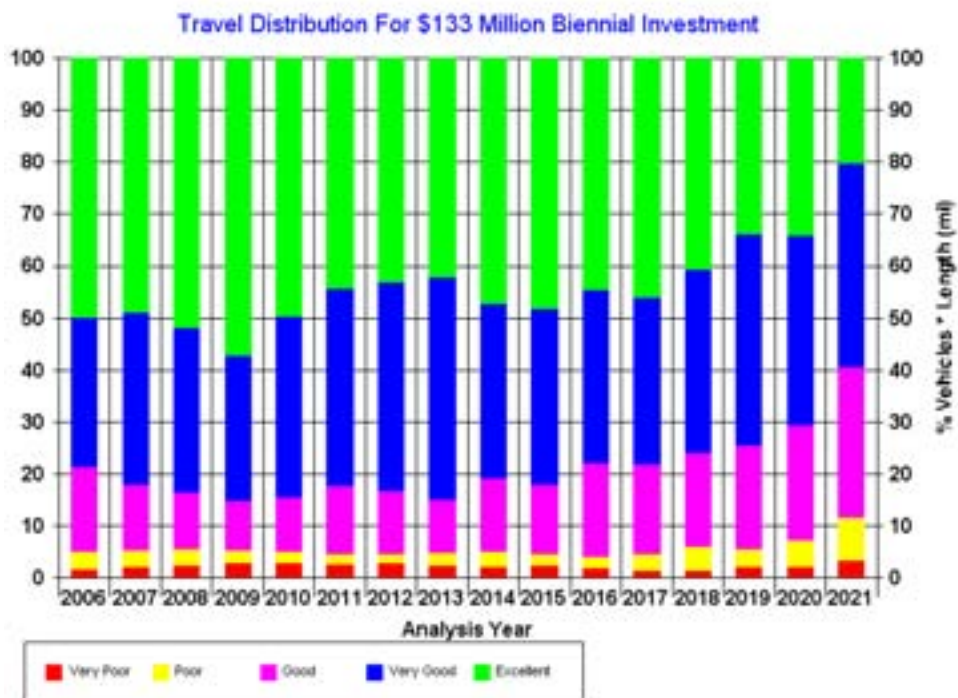
### Increased Funding (\$133 million per biennium)

The following charts show the average network condition distribution and travel distributions over time for built arterial and major collector highways that can be anticipated if status quo funding was increased by 40%:

#### 4.41 Condition Distribution for \$133 Million Biennial Investment



#### 4.42 Travel Distribution for \$133 Million Biennial Investment



## 4.0 Highways

### Bridging the Funding Gap

The Department is constantly exploring innovative treatments in an effort to make our pavement preservation dollars go further. MaineDOT's Bureau of Project Development, in cooperation with Bureau of Maintenance and Operations personnel and equipment, has been able to augment the total miles treated by the Pavement Preservation Program by using state highway crews to perform ditching on some projects the year before a pavement preservation treatment. This reduces the overall cost per mile for these projects, allowing more miles to be preserved.

Maintenance personnel and equipment have also applied maintenance surface treatment (STATE PPM) to some of our built highways using their own trucks, at a lower cost per mile than traditional project contracting methods for equivalent PPM treatments. In fact, the cost of applying maintenance surface treatment (STATE PPM) using MaineDOT haul assets is approximately one-half the cost of traditional contractor-delivered mix.

As shown in figure 4.41, a \$133 million capital investment per biennium will be necessary to maintain our built highway network in its current condition for the next 10 years. This level of benefit can be achieved by allocating \$111 million in capital expenditure combined with a \$10 million increase in the maintenance paving program to place maintenance surface treatment (STATE PPM) on 200 miles of built major collector per biennium.

MaineDOT Maintenance & Operations resources could place an additional 200 miles of maintenance surface treatment (STATE PPM) per biennium on our built major collectors at a cost of about \$10

The \$10 million increase in the maintenance paving budget in effect displaces twice the amount (\$20 million) in the capital budget.

million. This would require a shift in priority from highway maintenance activities such as cleaning culverts and ditching to more support for collector paving, however. As can be seen in the graphics 4.41 and 4.42, this level of investment keeps the built highway network in a relatively good condition for more than a decade.

### A Reality Check

In the 2006-07 Work Plan, MaineDOT programmed nearly 504 miles of roadway for pavement preservation projects with an average cost of approximately \$161,000 per mile for non-interstate projects. At this rate, and distribution of treatment types, it will take more than 16 years to treat the over 3978 miles of non-interstate built highway. Compounding this issue is the fact that the total number of miles entering the pavement preservation program is growing each year as highway improvement projects are completed. In order to close this gap there is a need for 400 miles of pavement preservation treatments per year, (300 additional miles per biennium), assuming an average treatment life of 10 years. At an estimated average unit price of \$161,000 per mile, the need would be nearly \$129 million per biennium. This level of investment is very similar to the investment recommendation provided by the Pavement Management Analysis software described above. This is a conservative estimate especially since construction inflation in the delivery of these improvements will result in a much higher cost per mile.

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### 4.6.4 Highway Mobility Needs

As part of its investment policy, MaineDOT invests in a wide range of strategies to improve highway mobility. These strategies include highway projects that improve mobility performance, with or without increases in highway capacity, and non-highway projects that offer improved alternatives to highway transportation. In accordance with the Sensible Transportation Policy Act (STPA), MaineDOT considers the full range of reasonable alternatives before investments are made to increase arterial highway capacity to address mobility needs.

As Section 4.5 illustrated, the future growth of traffic volume on Maine's arterials will lead to a rapid growth in traffic congestion if investments are not made to address highway mobility. Investments in mass transportation and non-highway transportation projects can enhance highway mobility by reducing the traffic demands on the highway network. Funding for these types of projects is addressed in the Passenger and Freight sections. Investments in highway mobility projects address highway mobility needs by physically improving the arterial network. This section focuses on the funding scenarios and implications for these highway mobility projects.

#### Potential Actions

Each of the three funding scenarios has an impact on the mobility outlook for the arterial network in the 26-year period from 2004 to 2030. Major mobility-enhancing strategies for highways include the following:

**Access Management:** Preserving and enhancing mobility and safety qualities of a highway by actions such as purchase of access rights, consolidation of driveways and entrances, and other improvements in access point geometry is called access management. Access management minimizes the potential for driveway/entrance traffic to erode the capacity, safety, and efficiency of an existing highway.

**Widening for Auxiliary Lanes:** Adding lanes such as left-turn (or right-turn) lanes and climbing/passing lanes to remove turning or slower moving traffic from thru lanes also enhances highway mobility. Turn lanes can be used effectively, with or without access management, on arterials where substantial turning traffic exists. Climbing lanes and passing lanes are effective on highway segments with a mix of vehicle speeds.

**Installing Thru Lanes:** Creating lanes on existing arterials to serve thru traffic provides significant increases in highway capacity where auxiliary lanes alone are not sufficient.

**New Thru Lanes at a New Location:** Creating new travel lanes on a new alignment to serve thru traffic is another highway mobility strategy. New highway capacity on a new location can serve large volumes of thru traffic that do not need access to the existing arterial.

In the last three BTIPs, more than 80% of the programmed funding for highway mobility projects was directed toward the strategies of adding thru lanes on either existing highways or new locations. Less than 1% of the funding was directed toward access management projects.

#### Mobility Funding Scenarios

For the last three BTIPs (2002-03, 2004-05, and 2006-07), the funding level for Mobility enhancing highway projects has averaged \$40 million per program. This programmed funding is in addition to other highway, bridge, safety, and non-highway capital expenditures described in this report. If this level of funding were to continue through year 2030, the investment in highway mobility projects would total

## 4.0 Highways

more than \$400 million in the equivalent of \$20 million annual increments. This is the baseline, or status quo, funding scenario.

To evaluate the effects of changes in the baseline funding scenario, two additional funding scenarios were developed. The reduced funding scenario, at \$16 million per year, is 20% less than the baseline scenario. The increased funding scenario, at \$24 million per year, is 20% more than the baseline scenario.

### Implications

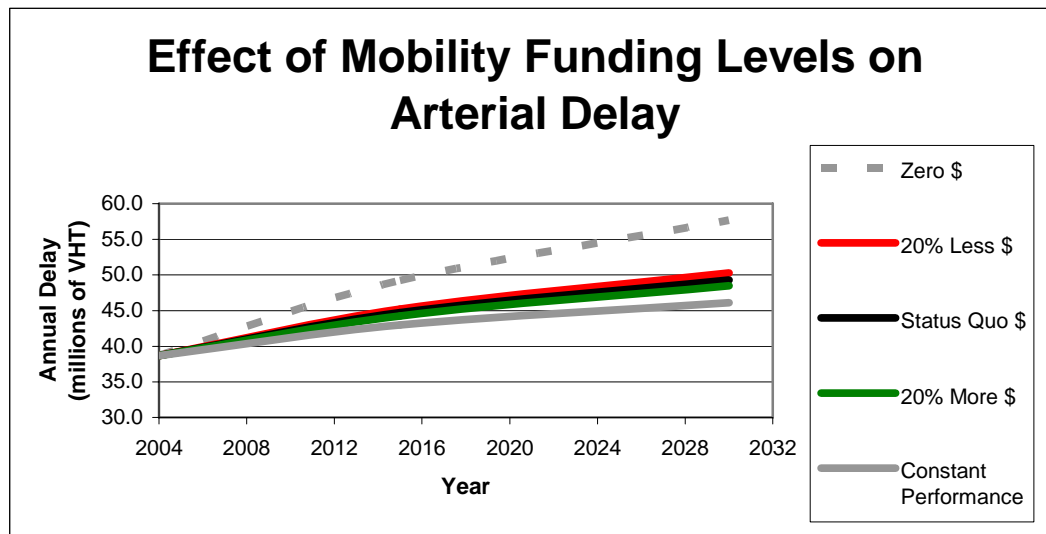
An optimum investment of funds under the three scenarios will result in a mix of investments best suited to the need to improve mobility in the arterial network. In figure 4.43 these potential mixes are shown for each of the three scenarios and compared to the historic mix of investments from the last three BTIPs. Under any of the scenarios, the optimal mix of investments is more balanced than the historic pattern of funding. The share of funding directed toward access management would be increased from near 0% to near 19%. If the annual investment level were to increase, the mix would shift slightly away from auxiliary lanes toward new thru lanes on new location.

**4.43 Potential Mix of Actions for Three Funding Scenarios**

Funding Scenario	Historic	20% Less	Status Quo	20% More
Annual Investment (\$ millions)	20	16	20	24
Mobility Improvement Strategy	Investment Share			
Access Management	0%	19%	19%	18%
Installing Auxiliary Lanes	20%	15%	13%	12%
Widening for Thru Lanes	39%	38%	37%	38%
New Thru Lanes at New Location	41%	28%	31%	32%

Figure 4.44 shows the impact of the three mobility funding scenarios on congestion in the arterial network as measured by annual delay VHT (Vehicle Hours Traveled). Under each of these scenarios, congestion in the arterial network increases, but higher funding levels result in smaller increases.

**4.44 Effect of Mobility Funding Levels on Arterial Delay**



For additional comparison, a “Zero \$” funding scenario and a “Constant Performance” trend line are shown as well. These two lines, respectively, are equivalent to the delay and travel growth trends in

## 4.0 Highways

Figure 4.30. The zero funding scenarios show growth in delay if no investments are made to improve mobility. The constant performance line shows a growth in delay that equals the growth in VMT. If the growth in delay follows the constant performance line, then travelers would experience the same amount of delay per mile traveled as they do now. In the constant performance scenario, increased delay on the overall system is a result of an increase in use, not a decrease in mobility.

Scenarios with lines above the constant performance line indicate worse mobility for future travelers than current conditions provide. The three funding scenarios will keep congestion growth well below the zero funding scenarios. They will not be sufficient to maintain a constant level of performance in the overall arterial network, as each of these scenarios lies above the constant performance line. The level of investment needed to maintain the current overall level of mobility performance is estimated to be \$60 million, annually.

In general, mobility improvements that have been funded in the past have had a benefit/cost (b/c) ratio of 2.0 or more. That is, the measurable benefits of the improvement are valued as being at least twice the cost of the improvement. If the funding strategy for mobility improvements is to fund all candidate improvements with a b/c ratio of 2.0 or more, an estimated \$25.6 million would be needed annually (\$51.2 million biennially). The level of funding to meet this strategic need is slightly higher than the “20% More” funding scenario (\$24 million annually).

### 4.7 Conclusions

**4.45 Maine's Highway Needs (in millions of 2005 dollars)**

Highway Network	2002-2003	2004-2005	2006-2007	STATUS QUO Investment Level (Average Over 3 Biennia)	To Maintain Constant Performance/Condition	Biennial Strategic Need
Highway Improvements	172.6	127.9	147.7	152.0	0.0	198.0
Arterials	75.6	75.1	84.4	78.4	0.0	82.0
Major Collectors	77.4	51.0	53.7	60.7	0.0	103.0
Minor Collectors	19.7	9.5	9.6	12.9	0.0	13.0
Pavement Preservation	102.0	97.0	69.6	89.5	111.0	111.0
Maintenance Paving	22.8	30.3	28.2	27.1	40.0	40.0
Highway Mobility	47.5	35.1	34.1	38.9	120.0	51.0
<b>Total:</b>	<b>345.6</b>	<b>295.4</b>	<b>290.5</b>	<b>310.5</b>	<b>271.0</b>	<b>400.0</b>

## 4.0 Highways

### 4.7.1 Highway Condition

Section 4.3 of this report illustrates the steady deterioration of pavement condition and ride quality network-wide since 1999, most notably in the minor arterial and major collector classes. This deterioration is likely to continue, and perhaps even accelerate, as a result of the combined effect of decreased funding of the pavement preservation program and the significant increase in construction costs caused by the volatility of the petroleum markets.

As shown in the analysis found in Section 4.6, a \$133 million capital investment per biennium will be necessary to maintain our built highway network in its current condition for the next 10 years. We have proposed achieving this \$133 million capital investment level of benefit by allocating \$111 million in capital improvement funds combined with increasing the Maintenance Paving program by an additional \$10 million to provide maintenance surface treatment (State PPM) on an additional 200 miles of built major collector per biennium. Lesser funding levels will result in continued deterioration of our overall built highway network condition.

### 4.7.2 Mobility

Sections 4.4 and 4.5 of this report have shown that VMT continue to increase on Maine's highway network and that traffic congestion, measured in vehicle-hours of delay, is increasing at a more rapid rate. Nevertheless, 90% of the arterial mileage in Maine never, or rarely, reaches its traffic capacity limits. In 2030, this percentage is expected to drop to 84%. Therefore, 10% of arterial mileage reaches capacity on at least a seasonal or peak-hour basis. That number would increase to 14% by 2030.

In Section 4.6, the cost of maintaining a constant level of mobility performance, with no overall increase in the delay per vehicle-mile, has been estimated to be \$60 million per year, or \$120 million biennially. However, this is a level of investment that would be excessive, as figure 4.46 shows. Annual funding levels of \$16, \$20, and \$24 million show reductions in delay that are worthwhile returns on the added investment. For example, a \$4 million annual funding increase (20% more) above status quo funding yields a \$10 million reduction in annual delay costs, a b/c ratio of 2.50. However, an additional \$36 million increase in mobility funding yields only \$28 million in reduced delay costs, a b/c ratio of 0.78. While a \$4 million increase in annual mobility funding is a cost-effective investment, a \$40 million increase is not. The \$24 million per year (\$48 million biennially) is close to the Strategic Need funding level to implement all improvements with a b/c ratio of 2.00 or higher.

**4.46 Cost Effectiveness of Mobility Funding Scenarios**

Mobility Funding Scenario	Annual Funding (\$ millions)	Annual Delay in 2030 (millions of VHT)		2030 Delay Reduction (\$ millions)	B/C Ratio of Added Funding
		Total	Reduction		
Zero \$	\$ -	57.7	0.0	\$ -	-
20% Less \$	\$ 16	50.3	7.5	\$ 90	5.63
Status Quo \$	\$ 20	49.3	8.4	\$ 101	2.75
20% More \$	\$ 24	48.5	9.2	\$ 111	2.50
Constant Performance	\$ 60	46.1	11.6	\$ 139	0.78

Also in Section 4.6, historic funding for mobility improvements has indicated that over 80% of the funds have been channeled to improvements that add thru lanes on either existing highways or new locations, but that less than 1% of mobility funding has gone to access management. In the future analysis of funding scenarios, adding thru capacity is likely to continue to be a major strategy, but access management should account for an increased share of the funding allocation for mobility improvements. Figure 4.46 suggested that 18 or 19% of mobility funding be directed toward access management.